Routledge Studies in the Economics of Business and Industry

ARTIFICIAL INTELLIGENCE AND FINANCE

COMPETITION, CRIMES AND FINANCIAL MANAGEMENT

Georgios I. Zekos

ROUTLEDGE

Artificial Intelligence and Finance

Artificial intelligence (AI) has been increasingly shaping the organization and operation of global capital markets by backing the consequences of algorithmic trading. However, concerns about the growing contribution of AI are mounting, particularly in relation to its potential to destabilize fair and orderly trading. This book examines the impact of AI on finance, financial management, competition, and crimes. It presents the AI-driven economy by combining a theoretical framework with econometric analysis and involves a discussion of the intersection of novel areas, including blockchain and AI. It investigates the AI-driven economy from four perspectives: economic impacts and financial implications, technological innovation, and political considerations. This interdisciplinary approach enables a holistic analysis of the subject, ensuring its relevance. The book begins by signaling the latest advancements in AI and its significance for the economy, presenting new forms of finance. It investigates the role of AI within financial markets, followed by an analysis of the role of AI on developments in finance, financial management, and governance, with an emphasis on the metaverse and Non-Fungible Tokens (NFTs), Central Bank Digital Currencies (CBDCs), cyber assets, and digital currencies. The role of competition in finance is highlighted, and financial crimes and their influence on financial markets are examined. The book will find an audience among researchers and students in the field of economics, finance, or business, as well as economists, lawyers, and financial and cybersecurity professionals.

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Georgios I. Zekos

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To my lovely wife
ΣΟΦΙΑ Π. ΓΡΗΓΟΡΙΑΔΟΥ

and to my son
ΙΩΑΝΝΗΣ-ΜΑΡΙΝΟΣ ΖΕΚΟΣ

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Introduction

AI is generating systems enabling machines to supplement or replace human intelligence in solving problems necessitating decision-making. AI systems are able to autonomously design their internal structure grounded on the input data and so achieve higher accuracy and performance in missions involving unstructured information such as text, sound, and images.[1] Furthermore, AI is a key characteristic of the data-driven economy owing to its capability to produce more data, information, and knowledge from existing data. Also, data-driven optimization strategies of AI agents reform market coordination. Moreover, AI agents reorganize operations, advance decision quality, and improve user commitment. Correspondingly, AI systems utilize algorithms and data in order to make predictions and so optimize an objective function. AI is utilized in areas such as portfolio management, trading, and risk management by optimizing asset allocation decisions through quantitative and textual data, causing trading signals and automating trades.

Digitalization of businesses is increasing across all types of sectors and disciplines. Also, digitalization and transformation of the labor market are new surroundings for corporations. Globalization, climate change, and digitalization are affecting societies, and industries, while networking, permit the sharing of knowledge by producing innovations with players from different industries, such as corporations, public sector organizations, and startups. Moreover, digitalization entails a reform incorporating both technical and legal requirements, as well as strong institutional commitments; thus, digitalization demands information technology, human resources, and financial resources. The aggressive growth of digital platforms and boundless capability to control social and economic lives have exploded antitrust as a device of politics. A system that cannot cope with increasing amounts of data in terms of storage, maintenance, and analytics becomes obsolete over time.

Due to AI technology, the financial markets have undergone structural and technological modifications such as networking in terms of connections between corporations and between market sectors, and so volatility is dispersed through the markets, threatening numerous players, which means that market instability in response to manipulation can take place.[2] To that extent, Gina-Gail S. Fletcher[3] argues that "Manipulative schemes can transmit and amplify systemic harms in the market by weakening intra-market networks, increasing volatility, and mispricing risk." Moreover, AI is used in finance to assist in making investment decisions and analyzing financial data.[4]

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Banks are entities to which governments allocate the sovereign task of creating, distributing, and managing the supply of money.[5] Moreover, bank merger policy averts dangerous consolidation of corporate control over the country's credit and money flows.[6]

Finance is interconnected with the acquisition, analysis, and processing of massive volumes of diverse forms of information. Today, finance, supported by technology, allocates and deploys economic resources across industries and market participants. It has to be taken into account that the utilization of cutting-edge financial technology transforms the internal mechanics of investing within the financial sector. Emilios Avgouleas[7] argues that "Fiscal and regulatory policies that include levies, subsidies, and waivers are arguably the most drastic way to reposition capital resources and implicitly delegitimize brown investing."

Even though cryptocurrency has not yet become a mainstream form of payment, retail investors are confident about the currency's long-term growth.[8] Corporations facilitating cryptocurrency trading and investing have emerged. Moreover, corporations engaging in financial mismanagement are driven by cryptocurrency's susceptibility to extreme market volatility and uncertainty, resulting in financial ruin for their customers.[9]

Technological progress is an exogenous variable and independently affects the equilibrium level of economic development. Moreover, the transformation of the business background has been rapid as a result of globalization and digitalization. Innovation efficiency encompasses the ratio of output to input, representing the competence of economies to translate innovation inputs into innovation outputs. Also, digital commerce platforms with cost-effective and easy access to large customer volumes have augmented the transformation. To that extent, the growth of digital commerce has formed digital commerce centers such as Amazon, Alibaba, and E-bay.

AI technologies present new challenges to the existing regulatory framework, demanding the creation of new regulatory infrastructures. As AI has become more powerful, high-level concerns have been exhibited about its impact on society and national security. It has to be taken into consideration that global information causes new challenges to national security.[10]

The digital economy grounded in digital technologies, entrepreneurship, knowledge, and intangible assets is contributing to economic growth, impersonating new challenges for economic policymakers, affecting holders of economic and political power in the field of tax policy. Hence, digitization and the intensive use of information are the unique features of AI Digital Economy. Digital financial alternatives with cryptocurrencies are alternatives to over-restrictive and slower banks that are keeping pace with digitalization.

Globalization is having the effect of "endogenizing" policy reform in developing countries. Greater integration into the world economy raises the payoffs to increased competitiveness but also compounds the losses from failure to act. To that extent, financial globalization is a free movement of finance across national boundaries without facing any restrictions, but financial liberalization is not a sufficient condition for financial globalization. Moreover, financial globalization means

that lending and borrowing countries should be merged into one market. Financial globalization refers to the process by which the financial markets of various countries of the globe are integrated as one. In fact, globalization has amplified the prospect of financial crimes. Also, crime has become digital via the use of digital devices and platforms, bringing forth a new era of crime and fraud.

Technological determinants of globalization encompass the development of high-speed cyberspace, advanced networks, and real-time data exchange, which means the transfer of information between global entities takes place at a rapid pace. Hence, due to globalization, individuals and corporations face greater exposure to product and product innovations happening across the globe, which usually causes a modification in preferences in favor of these products. Furthermore, globalization augments financial contagion by decreasing investors' incentives to gather market-specific information.[11] Thus, commercial globalization contemplates the existence of amplified transnational businesses and economic activities. A globalized world with cross-border trade needs globally interconnected payment systems. Big Tech corporations are offering advanced financial services, competing with traditional finance providers like banks and investment firms.[12]

It is characteristic that market concentration and the profitability of many corporations have both increased, and new classes of business corporations have developed. The globalization of the marketplace has conducted in an era in which the quality of corporate governance is a key element of corporate survival. The compatibility of corporate governance practices with global standards has become a vital part of corporate success. The practice of good corporate governance has developed into an essential requirement for any corporation to navigate successfully in the globalized market. Furthermore, risk management implies that agency conflicts can build a link between corporate hedging activities and governance mechanisms, which means that risk management is the duty of a company's management. Management has to estimate and manage a company's exposure to various risks, and so, corporate management is accountable to justify to the shareholders how much profit is generated from their assets that are under the fiduciary care of shareholders.

Competition laws safeguard national competition in the market and thus uplift global economic growth. Global competition keeps inflation in control, and free capital flows keep interest rates low. The economic rationale for intervening in markets is the happening of a market failure embracing excessive market power, information asymmetry, externalities, and behavioral market failures.[13]

A financial system assigns scarce resources to be utilized within the business sector in the most productive way. Technological innovation has amplified the effectiveness of the financial system via the offer of new financial products and services. New models of financial and digital infrastructures and providers are creating new opportunities but also presenting potential new risks requiring stability and security in those systems so as to safeguard value.[14] On the other hand, money laundering and other financial crimes have appeared as a substantial threat to capital markets.

A smart contract signifies an agreement utilizing blockchain technology as an enforcing medium.[15] AI algorithms analyze a large number of variables to "learn" patterns hidden within a vast amount of data and make predictions. Moreover, DeFi signposts a movement of alternative financial services that are inclusive, fair, transparent, and composable. In addition, NFTs turned into liquid assets can be employed for delivering, borrowing, and lending services.

It is characteristic that the aptitude of AI technology to enhance economic growth generates concerns regarding the fate of human workers in a world in which AI algorithms execute many of the functions that humans can. The protection of privacy and personal data has become a priority for many jurisdictions such as the European Union.

It could be said that regulating cyberspace is puzzling for the reason that it involves the laws of several competing jurisdictions, producing a range of impending legal overlaps. Cybersecurity awareness is rising as businesses are becoming digital due to the fact that their networks are vulnerable to attacks. In addition, executives are accountable for the security of data in their departments. Since the cyber threat landscape is always altering and new security solutions come to market all the time, security strategy is required to be reviewed regularly. Cybersecurity is becoming more dependent on AI. Hence, AI has to provide greater accuracy in detection and fewer false positives for it to earn trust, which means that digital transformation demands amplified cloud adoption and readiness to respond to rapid developments. It has to be taken into consideration that investment in cybersecurity is central, not only to protect sensitive information but also to ascertain trust as the basis of people's engagement in enriched e-governance, not mentioning that transparency reforms insights of e-government by promoting social involvement while tackling the emergent demand for e-trust.[16]

Blockchain enriches secure interoperability in telecommunications by allowing telecom networks and systems to connect and exchange data fluently,[17] which means that opportunities for securely and effectively connecting and exchanging information between diverse networks and systems are achieved. Also, with the development of 6G networks,[18] telecom networks are becoming more adaptable and capable of automatically extending their capabilities.

The current work deals with the impact of AI on finance, financial management, competition, and crimes. In the first chapter, the role of AI in finance on AI economy is analyzed in detail, underlining the new forms of finance. In the next two chapters, the role of AI in financial markets is investigated, followed by an analysis of the role of AI in the developments in finance, financial management, and governance with an emphasis on the metaverse, NFTs, CBDCs, cyber assets, and digital currencies. The role of competition in finance is highlighted in the next chapter, followed by an analysis of financial crimes and their influence on financial markets. Moreover, in the next chapter, an econometric analysis of the impact of finance, competition, exports, and trade on AI economy is analyzed grounded on data and IPR indexes. In the end, the final conclusions illustrate the outcome of the current analysis.

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1 AI and Finance

1.1 Introduction

Globalization boosts financial integration[1] resulting in higher resistance to potential shocks and refining the financial system. Moreover, globalization reduces trade barriers, increases technological innovation, stipulates better education, and generates an advantageous macroeconomic environment. Thus, financial reforms and assistance in technological innovation, particularly financial technology, are critical for promoting financial development, resulting in a more resourceful allocation of financial assets. The datafication of finance stimulates the financialization of the new economy, as financial transactions connect market participants around the globe and data is traded within and outside the financial system.

Financial contagion and spillover outcomes are asymmetric, where markets respond to positive and negative shocks in different ways and to different scales. Moreover, the integration of cryptocurrency and blockchain revolutionizes numerous industries, stimulating financial inclusion, transparency, and effectiveness in the advancing digital age.[2] It is characteristic that the financial industry offers the financial instruments that are needed in any business transaction, and managing the cost of financial instruments is diminished by the valuable use of technologies like blockchain and AI, which in turn slashes the cost of running corporations. Global financial markets have become gradually intertwined, and the SEC stated that regulators have to balance the aim of investor protection with the realism of the marketplace.[3]

So far, the power of AI technology seems to have been tremendously utilized by sellers, and pricing and data are central areas of policy in an AI-centric world. AI advances the capability to predict revenue outcomes of different policy options. Digitalization has caused faster and more effective service delivery by many corporations. Additionally, the consequences of digitalization for building sustainable sociotechnical systems are crucial for new, large-scale technologies.

It is characteristic that globalization instigates amplified international competition, expansion of global markets and opportunities, along with altering surroundings and necessities for management practices. Hence, organizations desiring to stay competitive and progressive have to adjust to these transformations and employ new management tactics. In other words, rising international interaction, fluctuations in the technological environment via the fast advance of information

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technologies, and altering consumer requests generate new challenges for organizations in a globalized world. Thus, productive management in such circumstances necessitates new approaches guaranteeing flexibility, innovation, and effectiveness in the actions of organizations.

It has to be taken into account that the use of modern communication and collaboration technologies assists businesses in preserving operative interaction with global partners. Thus, corporations have to advance intercultural communication management capabilities and adjust to different cultural backgrounds to operate effectively in a global milieu. Economic issues such as variations in global markets, trade agreements, and currency fluctuations have a noteworthy influence on the financial condition and strategies of corporations. Moreover, alterations in consumer lifestyles mark the market state of affairs and the perception of corporations' products and services. It is worth stressing that climate change, energy competence, and environmental standards are becoming gradually significant for businesses in order to ensure their triumph in a global AI era. Hence, innovation and digital transformation are vital for corporate advancement via the employment of advanced technologies, operative use of data and analytics, and warranting flexibility and responsiveness to swiftly shifting market settings.

Auditing uncovers the mistakes and shortcomings of corporations and thus spots the rightful organization of production, along with the application of innovative technologies. Hence, an innovation audit is about understanding the successful organization of innovation and identifying which components are working productively and where extra efforts and adjustments are needed. Thus, the utilization of AI and AAI (Advanced Artificial Intelligence) systems will allow the employment of the best factors in achieving the best outcome**.** Olga T. Cherney[4] et al. argue that "It is also necessary to note five fundamental principles that must be observed when conducting an innovation audit: honesty, objectivity, professional competence and due care, confidentiality, and professional behavior."

The current digitization of finance encompasses privately issued digital money and privately run digital payment systems; thus, these new technologies challenge the central balance of the sovereign public and private actors' relative powers and roles in the financial system. Moreover, AI systems increase private financial institutions' capability to over-generate risk and power in the financial system, without the parallel upsurge in the public's capability to control that process; therefore, AI technologies make financial services more competent and accessible.[5] Also, AI systems produce excessive generation and speculative misallocation of credit and money.[6] Hence, an unstable financial system influences economic and social stability; thus, finance is a device for the geopolitical status of a country. Kenneth Krushel[7] argues that

> "The influence of AI and the all-encompassing technological age, challenges our pedagogy, challenges how we conceive our language, our imposition of geopolitical heuristics, and how we grasp dominion over the earth as well as our capacities for good and ill."

1.2 Bitcoin as Money

It has to be considered that there is no need to distinguish the character of the transactions to assess a currency as a medium of exchange.[8] A currency being a safe store of value is the key element for a means of being money, which is questionable at the moment, for digital/virtual currencies. Nakamoto[9] was persuaded that the internet needed a currency that was, like it, decentralized, protected by cryptography, and favorable for peer-to-peer exchange. A group with pseudo-Libertarian political beliefs finds Bitcoin attractive owing to its lack of connection to any government, adhering openly to distrust of the world financial system, and the timing of Bitcoin's introduction, corresponding to the very bottom of the global financial crisis in 2008–2009.

Bitcoin[10] is a non-fiat cryptographic electronic payment system that claims to be the world's first cryptocurrency. It is a peer-to-peer, client-based, entirely distributed currency that is not based on centralized issuing bodies being a "sovereign" to function. The value is produced by the users, and the procedure is executed by utilizing an open-source client installed on any computer running Windows, Mac, Linux,[11] etc. In Spain, the judgment of the Supreme Court[12] 20/06/2019 denied the recognition of Bitcoin as legal tender (money) but considered it an "incorporeal asset."

Bitcoin is a homogeneous, virtual good that is entirely identical across all the online markets in which it is sold. The blockchain is a shared public ledger on which the entire Bitcoin network relies. It must be considered that network economics is a new field within the information society, and its principle is that products and services are produced and value is added via networks functioning on large or global scales. This is in contrast to industrial-era economies, in which ownership of physical or intellectual property originated from a single enterprise.[13]

On the one hand, the Court of Justice of the European Union ruled that Bitcoin was a virtual currency and that it could be accepted by the parties as a non-corporate means of payment.[14] On the other hand, the Paysera judgment[15] highlights that

> "the definition of electronic money, which is considered to be any monetary value stored by electronic or magnetic means which represents a claim on the issuer, is issued on receipt of funds for the purpose of making payment transactions (…), and which is accepted by a natural or legal person other than the issuer of electronic money."

To that extent, the Advocate General[16] underlines that

> "Bitcoin is not money as it does not fulfil the three functions of money: it is not a medium of exchange, nor a store of value, nor a unit of account. These assets are not backed or managed by any central entity, nor is there any guarantee that they can be exchanged for cash. They are slow, costly and cannot be used to pay everyday bills. Its transactions are slow, costly, and cannot be used to pay everyday bills. It is not issued by any central public authority,

> and it does not have the same level of trust as an official currency such as the euro, which is backed by the central banks of the euro area."

Hence, the Advocate General judges e-money to be Proton, miniCASH, Moneo, Geldkarte, and PayPal, and so, for the Advocate General, money is only stored in a network, the medium is "computerized" or virtual, and Bitcoin is not electronic money. Thus, the Advocate General's view disagrees with the opinions articulated by the CJEU in the Hedqvist judgment, where it deems Bitcoin to be a virtual currency, which is legal money for the reason that it is understood to be within the autonomy of the parties and what they consider to have value, and is eventually the object of exchange between them.

Bitcoin is differentiated from fiat money since it does not have the agency costs of public money. John O. McGinnis[17] argues that

> "If Bitcoin is to grow into a more stable currency, it will need financial intermediaries to do so…Thus, even for a cryptocurrency like Bitcoin that should not itself be regulated, there is this paradox: to succeed, these structures currently seem to require financial intermediaries to function optimally and those intermediaries create the very agency problems that Bitcoin is designed to avoid."

It is argued that Bitcoin does not entail faith in any public institution that creates money; on the other hand, it seems to be recognized that financial intermediaries are needed for its operation, which means going back to fiat money.

It is worth mentioning here that in order to flourish as a currency, Bitcoin and any other similar crypto require the same kind of financial mechanisms used to deepen the market for other financial assets, which means enabling price discovery and exchange-traded funds ("ETFs"). Also, while crypto was activated as a movement to free people's financial businesses from the state, now the government is getting into the digital asset game with central bank digital currency ("CBDC").

It has to be taken into account that the Bitcoin network operates as a public notary for all transactions conducted on the network, leaving a trace of what has transpired in the virtual universe, in cyberspace.[18] It is worth mentioning here that cryptocurrencies are deemed to be volatile and lack trustworthy information, making them dangerous investments.[19] The absence of regulatory certainty is a "massive barrier" to responsible innovation in the crypto ecosystem.[20] Furthermore, cryptocurrency is described as digital money based on blockchain technology. It is characteristic that Michael Conklin[21] considers that "corporate investment in cryptocurrencies and the acceptance of cryptocurrencies as payment violates the stakeholder theory of corporate ethics…accepting cryptocurrency for payment and holding cryptocurrency as an investment clearly violates the stakeholder theory of corporate ethics."

Payments and money transfers are the most obvious application of the distributed public ledger technology. Bitcoin transaction costs are much lower than those of traditional financial networks. The development of the "blockchain" is the innovative aspect of Bitcoin, which is a large decentralized database that has distinctive

identifiers for each user and each Bitcoin. Moreover, virtual currencies and Bitcoin have the potential to revolutionize the means by which payments are processed, but only if they become ever-present.[22] Could a broadly used virtual currency pose a risk to the stability of the financial system as a whole and to the economy more generally? It could be said that a virtual currency can be transformative if it is widely adopted, and a widely adopted virtual currency can threaten the financial system[23] as long as it is uncontrollable.

It is worth mentioning that it is very difficult to get accurate and up-to-date information about the number and volume of virtual currencies in circulation. The majority of virtual currency schemes have insignificant market capitalizations of below €1 million and only 21 exceed this figure; only the top eight are above €10 million.[24] Bitcoin[25] is clearly the largest and most well-established virtual currency, with a market capitalization of more than $28 billion.[26] On the other hand, Litecoin is scripted on an open-source global payment network that is never controlled centrally by any authority and uses a "scrypt" as proof of ledger, which can be decrypted through a consumer-grade CPU. It could be said that Litecoin has a faster block generation rate compared to Bitcoin and thus presents a much faster transaction validation. Ethereum was launched in 2015 and is a decentralized software platform that permits Smart Contracts and Distributed Applications to establish and run without any downtime, control, impediment, fraud, control from any other third party. Zcash is a more secure, open-source, decentralized digital cryptocurrency launched at the end of 2016, and it is regarded as more secure because all transactions are recorded and registered on a blockchain with details about sending and receiving parties, and the sum transferred remains secure by presenting a provision for shielded transactions. There are also a number of post-Bitcoin virtual currencies that claim to be superior to Bitcoin, including Litecoin, GeistGeld, SolidCoin, BBQcoin, and PPCoin,[27] Dash (Darkcoin), Ripple (XRP), and Monero (XMR). It is worth mentioning that command regulation has a reputation for being inflexible, which means suffocating competition and inhibiting enterprise and growth. On the other hand, flexibility is a problem with regulatory technology, but being capable of delivering more precise regulation. Even though precision is desired in financial regulation as in any other field of law, it comes at the price of flexibility. Computer scientists must solve this problem by developing software that operates within flexible legal terms.

Under English law, cryptocurrencies are to be treated as property and so the UKJT accepted that cryptocurrencies have the characteristics of property, including being definable, capable of being owned and transferred, and having value.[28] Hence, English courts recognizing crypto assets as "property" means that they could be the subject of a proprietary injunction.[29] In B2C2 v Quoine,[30] the court accepted that Bitcoins could be the subject of a trust, and so were property. Nonetheless, in New Zealand, cryptocurrencies were regarded as "digital assets," a form of property capable of being held on trust.[31] To that extent, A. Fowowe[32] argues that

> "While the US dollar has historically been the dominant currency in international trade, alternative currencies like cryptocurrencies and stablecoins

> are now more prevalent, opening up new opportunities for individuals and organisations to conduct cross-border transactions. However, using cryptocurrency also comes with legal difficulties, such as the issue of jurisdiction, whether cryptocurrency can be regarded as a property or being tangible under the Sale of Goods Act."

It is vital that recognizing the inner workings of monetary systems generates valuable insights into the function and stability of traditional monetary systems[33] and of the value of the alternatives offered by digital networks such as Bitcoin[34] and in general crypto-assets. Hence, monetary exchange is more valuable at promoting cooperation than alternative record-keeping systems. The important factor is not the type of money, but rather the equality between units of money and the units of value in the economy, which means that the value of money has to be equal to the units of value of the total worth of trade in an economy. If the exchange rate is not determined by the demand and supply of money and traded goods and services, then instability produces problems in an economy. Price is the variable reflecting the exchangeability of any item versus money. Money has no role to play when individuals depend on shared knowledge of past conduct to imitate patterns of monetary exchange.[35] Bigoni et al.[36] argue that

> "the differences in long-run efficiency, strategies and distribution of earnings in the Money and Memory treatments demonstrate that money performs a richer set of functions than just revealing past behaviors…the use of money imposes a discipline on what agents are willing to do in order to keep the economy on a cooperative track. Such findings suggest that well-functioning monetary systems are not simply rudimentary arrangements for monitoring past conduct in society, but play a richer role than previously thought."

The European economy rocketed once it was freed from a restrained money supply furthered by the development of new markets, new technology, and new payment systems that made possible long-distance commerce and movements of capital possible. Governments produce money themselves much more efficiently in the age of paper currency and electronic benefit transfers. Money is no longer tied to specie extraction.[37]

Finally, in the developed world, government fiscal activity is subject to some degree of democratic accountability, and fiscal endeavor is a manifestation of democratic politics.[38] Governments are now much more energetically involved in control over the private production of money. Central banks now control the money supply by amending the price of money through the setting of target interest rates. Money production has become monetary policy, achieving the politically desired levels of growth, employment, and inflation. Thus, market, governmental, and technological changes signify that the effectiveness of private money creation stemming from fractional reserve banking is no longer so self-evident, even if its inherent instability is more and more obvious.

Banking law restricts entry into money augmentation.[39] Morgan Ricks[40] argues that

> "private money often plays a central role in macroeconomic disasters, at least those emanating from the financial sector. The law of money encompasses the law of central banking…the law of money must also address the interface between public monetary institutions and private law."

Banking regulation alters how capital is distributed both across sectors within an economy and across jurisdictions, escalating competition among governments that want to maximize national welfare.[41]

1.3 Regulating Virtual Currencies

Unlike the United States, the EU has employed a legal framework for the regulation of electronic money. The Electronic Money Institutions Directive 2009/110/EC[42] outlines electronic money as electronically and magnetically stored monetary value and as epitomized by an entitlement on the issuer, which is issued on receipt of funds for the purpose of making payment transactions which means that the transaction is an act, instigated by the payer or by the payee, of placing, transferring, or withdrawing funds, regardless of any underlying obligations between the payer and the payee, and it is undertaken by a natural or legal person other than the electronic money issuer. Thus, it could be said that if a payment system accomplishes these prerequisites, then it is regarded as electronic money, and only electronic money institutions can issue electronic value. It must be considered that the vision behind this inflexible regulation is apparent, as what is taking place is the issuing of value into the economy. Therefore, Bitcoin would meet the legal definition to a certain degree, with the exception that it is not money that is issued in the consensus that is stipulated by the Directive. Due to the fact that there is no central issuing authority, it would be difficult to imagine how financial services authorities in charge of regulating EMIs could intervene in Bitcoin.

The ECB has expressed its view that a virtual currency like Bitcoin is "not money or currency from a legal perspective."[43] Sweden defines currencies as being, inter alia, "tied to a central bank or a geographic area." Bitcoin and other decentralized virtual currencies are designed to dispense with central bank and geographical localization, so they do not constitute "currencies" in Sweden. Many countries in the Eurozone have stated that virtual currencies do not constitute legal tender in their jurisdiction.[44] Moreover, FinCEN stated that "'virtual' currency is a medium of exchange that operates like a currency in some environments, but does not have all the attributes of real currency. In particular, virtual currency does not have legal tender status in any jurisdiction."[45]

The SEC does not have direct oversight of transactions in currencies or commodities, but the SEC is supervising the cryptocurrency-related activities of the market participants it regulates, including broker-dealers, investment advisers, and trading platforms. Moreover, the SEC is allocating a noteworthy portion of its resources to the ICO market. In addition, the CFTC and SEC, along with other federal and state regulators and criminal authorities, will persist to work together to bring transparency and integrity to these markets, thereby discouraging and

prosecuting fraud and abuse.[46] The SEC has issued investor alerts warning of the risks of cryptocurrencies and related products.[47] Moreover, the SEC has also issued investor alerts regarding the risks of original offerings of virtual currencies, and so, the SEC established a "Cyber Unit" within its Enforcement Division to pursue cyber-related misconduct, including violations of the securities laws encompassing distributed ledger or "blockchain" technology utilized by Bitcoin and initial coin offerings of virtual currencies.[48]

Bitcoin is tied to existing political economic structures and markets and is therefore implicated in the creation of wealth and power inequalities at multiple scales due to the fact that Bitcoin and the governance of the system are controlled by an elite class of capitalists, coders, and some corporations.[49] Furthermore, the SEC's rules for securities were found to apply even though the securities were purchased with Bitcoin[50] and as mentioned the CFTC has defined digital currencies as commodities.[51] Likewise, the usual regulations applicable to those involved in the trading of commodities apply in the digital currency situation as well.[52] In conjunction with the SEC, the Financial Industry Regulatory Authority ("FINRA") released an investor alert concerning the risks of investing and transacting in Bitcoin.[53] The SEC publicly supported the IRS's guidance of treating Bitcoin as property. Moreover, the SEC has become one of the federal agencies involved in enforcement actions and has pursued several Bitcoin companies for alleged fraudulent disclosures about business revenue and assets,[54] and for Ponzi schemes or fraud.[55] Moreover, the SEC ruled that the conduct perpetrated by the subject Bitcoin exchange constituted an investment in "securities," and therefore, the federal district court has subject matter jurisdiction pursuant to Sections 20 and 22 of the Securities Act of 1933 and Sections 21 and 27 of the Securities Exchange Act of 1934.[56] The SEC[57] argued that the defendant's Bitcoin product was a security for the reason that it constituted an "investment contract" under the language of the Securities Act's definition of "security," and an "investment contract" was originally defined in SEC v. W.J. Howey Co, where the Supreme Court said that an "investment contract" is "a contract, transaction or scheme whereby a person [(1)] invests his money [(2)] in a common enterprise and [(3)] is led to expect profits [(4)] solely from the efforts of the promoter or a third party."[58] Moreover, the SEC has treated Bitcoin as a security and applied antifraud and registration provisions of the securities laws, particularly Sections 5(a), 5(c), and 17(a) of the Securities Act of 1933, Section 10(b) of the Securities Exchange Act of 1934, and Rule 10b-5 of the Exchange Act.[59] While the SEC is only empowered with civil enforcement and administrative actions, it works closely with offering decisive information to the Department of Justice[60] to engage in criminal enforcement of the federal securities laws. For the reason that the SEC works closely with the CFTC, both agencies tackle options and futures in Bitcoin where regulatory overlap and coordination already occurs.[61] Lately the SEC rejected an application by well-known investors to generate an exchange-traded fund tied to the price of Bitcoin, in large part because the markets where Bitcoin is presently traded are mostly unregulated and the SEC cited the lack of regulation as creating "concerns about the potential for fraudulent or manipulative acts and practices in this market."[62]

In other words, crypto assets are sometimes called virtual currency, coins, or tokens.[63] If cryptos are securities under the test in SEC v. Howey Co.,[64] they are sold in line with the federal securities laws that currently govern corporations, which means registration with the SEC and initial and ongoing public filings.[65]

1.4 Monetary Policy and Financial Stability Policy

There is a monetary policy swapping between the pursuit of financial stability and the pursuit of price and output stability, which means that granting monetary policy another purpose produces confusion concerning the central bank's commitment to price stability and, therefore, diminishes the nominal anchor with potentially undesirable consequences for economic outcomes. Safe assets play a central role in financial stability and monetary policy because of their significance for collateral production and their implications for macroeconomic stability.

Is there a relation between monetary policy and financial stability policy? Monetary policy and financial stability policy are associated with each other and consequently, there is no dichotomy between monetary and financial stability policy. Monetary policy influences financial stability, at the same time "macro prudential" policies upholding financial stability have an effect on monetary policy. Thus, if it is suggested that "macroprudential" policies are controlling credit bubbles by slowing credit growth and, therefore, slowing the growth of aggregate demand, then monetary policy needs to be easier in order to counterbalance weaker aggregate demand. Zekos considers that "macroprudential" policies are controlling credit bubbles by allowing rightful and not inflated credit growth, thus permitting the growth of aggregate demand on a real basis and values of the economy and not inflated ones.

Monetary policy and policies toward financial stability are two sides of the same coin.[66] The typical approach in monetary economics underlines the substance of managing market prospects, and this prospect conduit of monetary policy turns into the prevailing matter in many central banks, particularly among those that follow inflation targeting.[67] Milton Friedman and Anna J. Schwartz[68] argue that "leaving monetary and banking arrangements to the market would have produced a more satisfactory outcome than was actually achieved through governmental involvement."

Instead, if policy rates are kept low to accelerate the economy, there is a greater risk that a credit bubble might occur, requiring tighter "macro prudential" policies to make certain that a credit bubble does not get on track. Therefore, the synchronization of monetary and "macro prudential" policies is essential in order for the three objectives of price stability, output stability, financial stability to be achieved. Frederic S. Mishkin[69] argues that

> "financial sector plays a very prominent role in the macro economy and makes it highly nonlinear at times. This requires that we abandon the linear-quadratic framework for thinking about how to conduct monetary policy when there is a financial disruption. There is now a stronger case for a

> risk management framework that factors in tail risks that can produce very adverse outcomes for the economy…there is a stronger case for monetary policy to lean against credit bubbles (but not asset-price bubbles per se), rather than just cleaning up after the bubble has burst. Using monetary policy to pursue financial stability goals is not an easy task, however, and research on how to monitor credit conditions so that it decisions to use monetary policy to restrict excessive risk are based on the correct information will be a high priority for research in the future. Finally, the financial crisis has made it clear that the interactions between the financial sector and the aggregate economy imply that monetary policy and financial stability policy are closely intertwined."

Financial innovation and the new means to transfer credit risk lessen the informational substance of standard bank balance-sheet indicators. Bank risk surroundings need to be considered in conjunction with other indicators such as size, liquidity, and capitalization conventionally used to consider a bank's capacity and readiness to supply new loans. Banks illustrated by lower projected default rates are able to put forward a larger amount of credit and to better protect their loan supply from monetary policy alterations.[70]

The euro area banks play a key role as one of the central conduits for the execution of monetary policy, having a fundamental stance in the financial system. The function of banks in the execution mechanism is altered, primarily for the reason that the business of banks has undergone essential modifications in recent years, as a result of financial innovation, financial integration, and an upsurge in market funding.[71]

Ingredients of the banking area have moved away from the conventional "originate and hold" to an "originate and distribute" pattern of the banking company, which is much more dependent on market forces having an influence on the manner they award credit and respond to monetary policy desires. Borio and Zhu[72] say that financial innovation, in correlation with alterations to the capital regulatory framework (Basel II), enhanced the effect of the perception, pricing, and management of risk on the methods of banks. Also, Rajan[73] says that more market-based pricing and stronger dealings between banks and financial markets aggravate the motivation structures driving banks, leading to stronger relations between monetary policy and financial stability consequences. Likewise, W. Breuer and A. Knetsch[74] argue that

> "Yet another breakthrough in digital finance is the emergence of decentralized finance, mainly characterized by cryptocurrencies and security tokens. The overall market capitalization for cryptocurrencies is around 1.19 trillion USD as of July 2023. These currencies act as an alternative to the conventional fiat currencies where consumers can utilize them for payments without the role of intermediaries, hence serving as a medium of exchange."

It is worth mentioning here that due to the fact that the central bank is decisive in shaping monetary policy,[75] the increasing acceptance and use of cryptocurrencies

are key development in the global financial landscape. The central bank ascertains the discount rates, which are the interest rates at which commercial banks borrow money from the central bank, thus shaping the interest rates charged by commercial banks to their customers and shaping the cost of borrowing for individuals and businesses. Consequently, employing cryptocurrencies will abolish the demand for financial and foreign exchange middlemen, reallocating currency supply away from central banks. Thus, this existing monetary structure was formed to affect inflation, economic growth, and financial stability by controlling the amount of money in circulation, which means that the uncontrolled production of means considered to be money in circulation will inflate the global financial system in due course according to the will of the elite controlling the whole cyberspace system and, consequently, the global economy owing to the advancement of the AI economy.

1.5 New Technologies and Dollar

Is there a need for the establishment of a new international monetary system encompassing electronic money? Have cryptocurrencies and crypto assets been influenced by conventional monetary policies? Will the dominance of the dollar be demolished due to the political failures of the United States in the global arena? The US hegemony over the international system has given its currency dominance over the global monetary system. Due to AI technology and the new political and economic reality of the global balance of power, a new global political and economic order has caused the global system's transformation. It has to be taken into account that the dollar's influence caused a financial crisis that affected European currencies via a decline in the value of their currencies expressed by a sharp increase in inflation rates and a fall in the competitiveness of their products. Moreover, the global system is experiencing a rapid end to the system of unequal exchange between Western countries and the rest of the world, along with an upsurge in the number of regional crises influencing the dollar's circulation. The China Securities and Regulatory Commission revealed that petroleum oil futures contracts commencing trading on March 26, 2022, will be denominated in Chinese Yuan rather than US dollars. Hence, de-dollarization is the process of dropping the use of the US dollar in international transactions and shifting to other currencies or payment systems.[76] Subsequently, the fluctuations in the dollar's value had effects on the global economy, and so the dollar exchange rate advances the competitiveness of foreign economies, principally US corporations, causing higher growth rates in these countries, entailing substitution effects and income effects. Moreover, there is a substitution or transfer consequence when fluctuations in the exchange rate influence the profit of a foreign sector in the international market at the expense of sectors in the dollar area. On the other hand, because of the transformation of the global economy and the rise of noteworthy global powers such as China,[77] the global economy is experiencing sub-regional trade, investment, and financial reform. To that extent, Osama Wagdi et al.[78] argue that

> "The global oil market is ready to abandon the petrodollar; the weight of giving up the petrodollar will be more than 50% of the oil market; it will most likely take three to five years. Russia and China are attempting to undermine U.S. control over the global monetary system for political reasons."

Currently, US hegemony over the global monetary system means that the dollar will maintain extensive global dominance, which will be destabilized by the entrance of unrestrained cryptocurrencies and crypto assets in the global market, which will be handled by AAI systems that seem not to be controlled by the current elite unless the forthcoming AAI systems run by AAI humanoids are controlled behind the curtains by an AAI elite.

It could be said that China's digital yuan sets a noteworthy challenge to the current dollar-dominated monetary order because the digital yuan serves not only China's external objective of international digitalization but also another pole of countries opposing the dollar's domination.[79] In other words, China's digital yuan serves both its international objective of a greater role for the yuan in its mission to confront the dollar-dominated order and its national objective of greater state control over private money. Hence, it could be said that the digital yuan is not only a medium of exchange but also digital yuan as a digital currency confronts any private cryptocurrencies trespassing into the traditional domain of sovereigns. To that extent, Lan Cao[80] argues that "yuan internationalization and digitalization should be understood and considered within a wider context, possibly signaling the beginning of the end of dollar hegemony."

1.6 Metaverse in Finance

AI and robotics technologies are amalgamated in several economic sectors such as financial trading and analysis. Algorithmic trading, driven by AAI algorithms has transformed market dynamics by permitting automated execution of trades. Hence, the integration of AI and finance has reformed the financial landscape, and by utilizing AAI, the speed, security, and efficiency of financial markets are improved. In line with this, blockchain technology, augmented reality (AR), and virtual reality (VR) have allowed the materialization of the metaverse[81] being a virtual space where people interact comparably to the real world. To that extent, the metaverse is linked to the crypto-metaverse as a result of the strong integration of blockchain technology and cryptocurrencies into virtual environments.[82] In other words, the metaverse is a principal environment for the conception, trading, and ownership of digital assets and cryptocurrencies, generating the metaverse sphere for the global financial market. Thus, digital art, virtual real estate, and gaming tokens are acquired, sold, and traded within a digital terrain with the assistance of metaverse cryptocurrency coins and tokens. In Italy, tokens have been considered as "digital assets" under the provisions of Article 810 of the Italian Civil Code[83] and in France[84] tokens are regarded as "incorporeal assets."

DeFi platforms are looking for opportunities within the metaverse, which means that users are involved in DeFi services like borrowing, lending, and gaining profit

without leaving the virtual world. Blockchain technology and cryptocurrencies not only advance accessibility but also launch new ways for earning and employing cryptocurrencies. Thus, the metaverse alters the complexion of financial services which means that virtual banks, insurance companies, and investment platforms materialize within this digital world, presenting users with an alternative to conventional financial institutions. To that extent, smart contracts automate financial agreements, diminishing the requirement for intermediaries and intensifying the effectiveness of transactions. Thus, incorporating the metaverse into finance boosts global financial system accessibility by eliminating traditional barriers, inspiring innovation in financial services that lead to new products and solutions, and stimulating financial inclusion.[85]

Fintech is transforming finance and contesting current regulations linked to financial inclusion. Moreover, virtual banking is distinguished from electronic banking owing to its absence of any reliance on physical infrastructure.[86] While virtual banks run exclusively online, traditional banks can offer more banking options in advancing market choice and, by this means stimulating financial inclusion without inevitably being digital. Hence, virtual banks, fintech start-ups, and online-based payment firms enter the supply side, advancing market selection and so, amplifying financial inclusion. Also, virtual banks boost financial inclusion by providing easier and faster bank account opening, easier modes to deliver identity for compliance with KYC requirements,[87] and algorithmically driven decision-making for loan approval. On the other hand, traditional banks and virtual banks are subject to the same regulatory supervisory standards.[88]

Interoperability among digital platforms[89] is a key attribute of the metaverse[90] and so the metaverse represents a prospective "parallel judicial universe, an independent meta-system with its own virtual jurisdiction."[91]

It has to be taken into account that when a publicly traded company is attacked, the damage extends beyond the organization, causing financial losses to shareholders. To that extent, the appearance of the metaverse increases the attack surface for malicious players by generating more entry points for malware and data breaches. In line with this, by selling encrypted data back to its original owners, offenders obtain profits from personal data that had little value on the black market. Thus, digitization and the explosive growth of online business have caused cyberattacks, and corporations have become attractive targets. For the reason that corporations have centralized their data into information networks to augment competence, consumer data are more easily targeted in an attack.[92]

1.7 AI, Decentralized Finance (DeFi), and NFTs

AI's capability to produce distinctive content through algorithms displays a novel approach to NFT formation, where digital artworks are created autonomously or in collaboration with human artists. AI is not only an instrument for producing NFTs but also for managing them, which means that advanced algorithms investigate market trends, user preferences, and other data to propose NFTs to prospective buyers, thus augmenting the discovery process in

marketplaces. Hence, AI competencies are seen as an instrumental asset for both creators seeking visibility and collectors looking for their next acquisition. In other words, AI's function in NFTs allows confirming the authenticity and originality of digital assets, which means that AI aids in identifying prospective copyright infringements or duplicates and so warranting the integrity of the marketplace. Nonetheless, the employment of AI in the NFT space causes concerns regarding authorship and copyright, particularly when AI-generated artworks become tokenized as NFTs. Thus, while AI technology progresses, its impulsion on the NFT ecosystem is increasing and restructuring the terrain of digital creativity and ownership.[93]

It is characteristic that the success of new product development efforts is based on the creativity of the underlying ideas, which means that creativity encompasses the production of new ideas that are both original and valuable. Therefore, innovation comes as an implementation of ideas into new products and processes. Consequently, creativity is regarded as the first stage of the innovation process, followed by implementation. What is the role of AI in creativity? AI will be utilized in generating new innovations instead of humans due to its capacity, and so, AI creations have to be awarded the relative IPRs.

It has to be taken into account that the synthesis of Decentralized Finance (DeFi) and NFTs[94] denotes a considerable evolution in the digital economy, and so, this convergence presents innovative financial products and services, escalating the utility of NFTs in finance. DeFi platforms employ blockchain technology to generate financial systems that run without central authorities, such as banks or governments, presenting services like lending, borrowing, and investing directly on the blockchain. To that extent, NFTs are becoming fundamental to DeFi by representing distinctive assets utilized as collateral for loans or as part of investment strategies. In other words, an NFT art piece employed as collateral to secure a loan on a DeFi platform opens up new liquidity prospects for NFT holders, permitting them to leverage their digital assets without selling them. Hence, DeFi projects tokenize real-world assets as NFTs, making them tradable and functional within the DeFi ecosystem, and so, tokenizing property titles, luxury goods, or unique experiences, which means that NFTs expand involvement in DeFi, advancing more diverse investment opportunities. Nonetheless, amalgamating NFTs with DeFi brings forward complexities, such as evaluating the value of irreplaceable digital assets for collateral reasons and handling the risks linked with their volatility. Hence, the decentralized character of these platforms presents extra challenges in safeguarding security and averting fraud, and so, demanding constant innovation in design and platform governance. In line, Chen Jun and Danny Friedmann[95] argue that

> "NFT platforms explicitly point out that if one buys a "digital collectible," one will get the NFT in combination with copyright of the underlying work. Its monetization process is linked to fiat money (namely the Renminbi), but the tradability of NFTs is limited to trade within separate platforms/chains."

1.8 NFTs and Digital Economy

As mentioned earlier, the advent of NFTs is affecting the digital economy by presenting novel notions of ownership, value, and exchange in digital spaces. To that extent, NFTs confront conventional economic models by allowing digital assets to be uniquely owned and traded, much like physical assets and, thus, obscuring the lines between the tangible and intangible in economic terms due to the fact that NFTs redefine ownership. It could be said that blockchain-based proof of ownership for digital items means that NFTs form scarcity and exceptionality where duplication was once inexhaustible. Hence, scarcity is becoming a central economic principle that NFTs apply to digital content, possibly escalating its value and making it a tradable commodity within the digital economy. Likewise, NFTs are accelerating the formation of new markets and opportunities for monetization, which means that artists, musicians, and creators can sell directly their digital works to a global audience, sidestepping established intermediaries and, thus, keeping a larger share of the profits. Thus, the AI economy not only energizes creators but also accelerates a more active and diverse marketplace for digital goods. In line with this, Joerg Osterrieder[96] et al. argue that

> "the implications of NFTs for the digital economy are profound. They are catalyzing a shift towards a more decentralized and creator-centric marketplace, where digital assets are recognized and valued in new ways…t's clear that they are not just a passing trend but a significant evolution in the digital economy, with the potential to reshape how we create, share, and value digital content."

It is worth noting that given that cryptocurrencies are the default money for NFT transactions, their price patterns expose this interconnection. Hence, NFTs are exchanged in cryptocurrency exchanges but largely perform as digital assets, holding value, empowering transactions, and operating as units of account. To that extent, exploiting NFTs to ascertain digital ownership is innovative and safe, thus inserting security into ownership claims and enhancing trustworthiness. Also, prior to NFTs' appearance, there were no decentralized ways to quickly and definitively authenticate digital artwork ownership. It is argued that NFTs, predominantly in decentralized finance (DeFi) sectors, steer more as a result of investors embracing a collective mindset and following investment trends, resulting in a shortage of rational asset analysis, which means that NFTs are considered to be a different asset class from other cryptocurrencies.[97] Moreover, NFT price dynamics were tied to Bitcoin market movements and trends in its early phases. Suliman Alshahmy[98] et al. argue that "In today's financial landscape, emerging digital assets' independence from conventional financial instruments is important. This theory holds that cryptocurrency prices drive the NFT market." It seems that NFT and cryptocurrency markets have acquired attention for their value due to the explicit causes of price variations and their consequences. Also, Bitcoin market efficiency and returns are time-varying, and so, Bitcoin investor attention concentrates on its links with returns, trading volume, volatility, and liquidity. Weiwei Guo[99] et al. find that

"factors such as changing user composition and increased regulatory scrutiny alter the dynamics of on-chain factors and their influence on market efficiency."

It is characteristic that buyers are expected to exploit the NFT as collateral to fund their purchase, rather than taking a traditional mortgage. R. Wilson Freyermuth[100]et al. argue that

> "the NFT financing model is not a mere technological upgrade, but rather transports parties out of the domain of traditional mortgages and into secured transactions law, with significant legal and policy implications. Most worryingly, it exposes borrowers to swift and irreversible home liquidations in cases of default, robbing them of the protections historically afforded to homeowners."

Hence, these dealings are still real property acquisitions financed with a loan.

Finance has become one of the most globalized and digitized sectors of the economy. Moreover, globalization, digitization, and money are boosting AI in finance forward at an ever-increasing pace. In line, Zetzsche[101] et al. argue that

> "the use of AI in finance comes with three regulatory challenges: (1) AI increases information asymmetries regarding the capabilities and effects of algorithms between users, developers, regulators and consumers; (2) AI enhances data dependencies as different day's data sources may alter operations, effects and impact; and (3) AI enhances interdependency, in that systems can interact with unexpected consequences, enhancing or diminishing effectiveness, impact and explainability. These issues are often summarized as the "black box" problem: no one understands how some AI operates or why it has done what it has done, rendering accountability impossible."

It must be taken into account that the expanding uses of black box AI[102] by governments and private corporations can have negative outcomes for people due to malfunctioning algorithms and so, affecting an entire economy, which means that it is imminent the development of AAI tools for controlling and correcting AI predictions and AI decision-making automatically. Brandon L. Garrett and Cynthia Rudin[103] argue that "Regulations and statutes regarding the deployment of AI in criminal law settings should directly require interpretable and validated AI."

It could be said that bolstering cyberspace governance of regulated financial market participants through external regulation is the way forward in Al era. In other words, the most effective course forward implicates regulatory approaches which bring the human into the loop, augmenting internal governance through external regulation. Thus, the application of the principles of governance in an Al environment is an answer.

In the context of finance, the post-crisis concentration on personal and managerial responsibility systems offers a central external framework to augment internal accountability in the context of AI, which means that AI-tailored manager responsibility frameworks, augmented in some cases by independent AI review committees, as developments to the conventional three lines of defense, are the most

effective way of dealing with AI-related matters not only in finance concerning "black box" problems but also possibly in any regulated business.

In the end, the use of AI for managerial tasks implies that AI technologies are a new set of agents in corporations. Moreover, AI systems have practically unlimited information-processing capability and present perfectly consistent behavior. However, they can introduce statistical biases due to unsuitable data; thus, AI and shortly AAI systems have to be utilized in order to correct any biased data instantly. In other words, current AI can be pre-programmed to engage in clear mathematically defined goals while taking into consideration legal and ethical constraints. On the other hand, AAI systems can objectively run and directly correct any algorithm by instantly choosing to insert of the newest unbiased data. Additionally, AI technology is projected to deliver welfare and security, which makes it a strategic resource for governments, meaning that AI should not be an elitist project handled by political-administrative and corporate interests.

1.9 Financing Startups

It has to be taken into account that financing new ventures is risky and characterized by asymmetric information and multiple incentive problems. In other words, most startups are not attractive borrowers. Venture capital backing substitutes for positive free cash flows in the context of startups and that intellectual property performs a central role function in substituting tangible assets as collateral, making venture debt attractive to lenders. Moreover, early-stage venture capitalists choose venture debt if their portfolio corporations have low upside prospective and if they cannot gain from the value that a late-stage venture capitalist adds or if uncertainty is low. Consequently, a venture loan is comprised of two key elements: a loan and warrants.

Startups typically have no positive cash flow, little collateral to offer, and high bankruptcy rates, making them poor loan candidates. Nevertheless, venture loans, as a hybrid form financing, embrace both a loan and a warrant and are used in practice.

In other words, innovative startups have limited access to debt, not having positive cash flows (yet), have inadequate collateral assets, and are portrayed by uncertainty concerning the success of their business model and high bankruptcy rates. Also, venture loans are regarded as "hybrid form" of financing between straight debt and convertible bonds, which means that venture loans are frequently linked with the maturity of the startup, performance-oriented investor types, and startups with financially strong committed investors. To that extent, new ventures are subject to the liabilities of newness and smallness, meaning their bankruptcy rates are higher and their access to resources is limited compared to those of established corporations. In line with this, Nico Lehnertz et al.[104] argue that

> "venture loans are associated with strongly committed existing investors, which stimulates the requirements of venture lenders and is signaled through large invested capital amounts per investor in previous rounds. Furthermore,

> we find that venture loans are associated with rather mature startups and offer empirical indication that the medical, health, and life science industry with clear milestones provides good conditions for venture loans."

The warrant permits the venture lender to participate in the return of successful exits and so, in contrast to straight debt, a venture loan offers upside potential. Nonetheless, a venture loan has to be distinguished from convertible notes that are often offered by existing or future equity investors. To that extent, the intellectual property of new ventures is advocated as a substitute for missing tangible assets as prospective loan collateral, and so, patents are imperative tangible assets offered as collateral for venture debt.[105] Thus, startups offering appropriate intellectual property as collateral and as quality certification are appropriate candidates for venture loans.[106] Moreover, with increasing maturity, startups gather tangible assets and become more profitable, leading to an increase in debt use.[107]

The financial growth cycle of startups usually starts with one's own capital injections and support from family and friends, followed by participation from business investors. Thus, startups in intermediate or later stages of the lifecycle attract venture capital investors.

1.10 Finance Models

Increasing digitization and automation of processes in all parts of society have initiated a deliberation on whether people want to count on algorithms. Simultaneously, algorithms present openings for new business models relying less on human decision-making and human interaction, but more on pre-defined rules and processes. The financial industry offers many applications for algorithms in trading, asset management, and financial advice. Robo-advisors grounded in algorithms are utilized to help human fund managers or investment advisors. M. Germann and C. Merkle[108] argue that

> "Participants acting as investors can tie their incentives to either a human fund manager or an investment algorithm. We find no sign of algorithm aversion: participants care about returns, but do not have strong preferences which financial intermediary obtains these returns. Contrary to what has been suggested, participants are neither quicker to lose confidence in the algorithm after seeing it err. However, we find that participants' inability to separate skill and luck when evaluating intermediaries slows down their migration to the algorithm."

As a result of economies of scale, algorithms present low-cost products and advice to retail clients serving many people at a time, while fees for human financial advice are often prohibitive for small investments. Financial algorithms now directly interact with retail investors, and new fintech corporations relying on technology enter the market for investments all over the world.[109]

Financial technology is improving financial processes and activities predominantly through the use of computers and smartphones. Robo-advisory platforms

use algorithms to present financial planning services without human supervision, thereby delivering asset management solutions that are both more transparent and less expensive.[110] It could be said that the decentralization of finance has advanced the development of innovative financing formulas based on which corporations, entrepreneurs, or project developers raise funds in open calls through cyberspace, receiving cryptocurrencies in exchange for digital assets entitling buyers to an exclusive right, reward, or financial claim.[111] Yan Chen et al.[112] argue that

> "decentralization has an inverted U-shaped relationship with platforms' market capitalization, developer attention, and development activity. We further examine factors driving the decentralization of platform governance and find that digital platforms of the infrastructure layer—relative to those of the application layer—have a tendency to become more decentralized. This tendency, nevertheless, can be offset by experienced leaders to achieve semi-decentralization."

Tokens representing ownership of an asset, such as corporate debt and equity, are called security tokens, and their purchase through an STO is considered an investment subject to securities laws.[113] Contrasted with traditional financial products, the issuance of blockchain-based tokens through ICOs/IEOs/STOs presents enhanced public tradability, transparency, low entry barriers, competence, automation, and high-cost efficacy being both alternatives and complements to other innovative sources of financing, such as crowdfunding and VC.[114]

Taking into account that Blockchain[115] platforms are written in code, empowering data ownership and decision-making processes, blockchain facilitates groups of stakeholders to collectively produce and distribute value among themselves in new and more decentralized modes.

Business financing optimizes the mix of loans, bonds, common stock, and many other feasible facilities. Moreover, the ampleness of a particular mode of financing a business diverges depending on the precise situation of the corporation and the economy. New corporations are not able to acquire loans or issue debt.[116] Moreover, information asymmetries over and above interest payments inadequate to compensate financiers for the fairly high possibility of losses are among the reasons which means that new corporations have to count on equity financing, encompassing the additional advantage of investors who support the management with their own experience and networks.

It is characteristic that in a centralized token economy,[117] central players allow interoperability with other central players so that tokens are transferred between them across digital platforms via SWIFT. Moreover, technologically, asset ownership management counts on digital platforms controlled by central players and, therefore, controlling a platform has power over the stored data since the processes executed via the platform cannot be authenticated by other players. Also, the main players gather decision rights for the governance of provided digital platforms, dependencies on the central actors are augmented, and all individual players have to trust the central players. Likewise, players have to trust that the central player will not stop offering services on a digital platform or increase service fees.

On the other hand, a decentralized token economy tackles drawbacks linked with the involvement of central players in asset ownership management by cutting dependencies on central players and their digital platforms. Hence, various players cooperatively run a digital platform, dividing the linked duties, such as for platform upholding.[118]

The decentralized token economy empowers direct transactions between players without mediation by banks, which means improving cost competence and via tokens boost suppleness in managing asset ownership which means that multiple players can contribute to decision-making for the central missions in asset ownership management that are presently executed by central players. Correspondingly, DLT permits the automation of key assignments of the central players entangled in centralized token economy. Therefore, cross-ledger interoperability (CLI) advances the technical capabilities to connect isolated DLT systems prevailing over shortcomings, such as limited network consequences and suppleness in business relations, which means that technical standards empower digital support of governance mechanisms.

The goal of centralized exchanges (CEXes) is to offer a method to trade and custody currencies and cryptocurrencies. A decentralized exchange (DEX) offers a method to trade cryptocurrencies in a peer-to-peer manner using smart contracts, thereby reducing default or scam risks and adding privacy delivering full transparency. Nevertheless, a DEX presents the likelihood to trade most cryptocurrencies at any time via a system of automated market.[119]

Tokenization[120] permits trading via a distributed ledger, a variety of ownership and access claims, licenses, and royalty rights as an alternative to conventional, paper-based exchange. Also, tokenized claims concern both physical and digital assets, which means that tokenization offers investors a new mode to obtain "fractional ownership"[121] and so, investors can swap tokenized claims for physical assets such as real estate, artworks, etc. In other words, "tokenization" concerns the holding and transfer of financial assets on decentralized blockchains or distributed ledgers.[122] In line, Rosa M. Garcia-Teruel and Héctor Simón-Moreno[123] argue that "private law rules may be adapted to the tokenization of property rights, which may contribute to the establishment of a digital market for the trading of asset-backed tokens worldwide."

Concerning tokenization, Darian M. Ibrahim[124] argues that

> "crypto issuers would be required to include a short, prominent "warning box" on their websites that includes only unexpected and harmful features of the crypto. Coupled with the whitepapers already provided by crypto developers—a shining example of voluntary disclosure working—the warning-box add-on completes the crypto regulation picture and properly balances innovation and investor protection."

It has to be taken into account that legislation is illustrated as too weak and slow to protect individuals in a rapidly developing technological world due to the fact that changes in the technological setting are so quick and profound that regulations become quickly ineffectual at appropriately protect individuals.[125]

Crowdfunding is the process of raising capital for a campaign, a project, or a new business through the rather small contributions of a fairly large group of individuals over a set period of time, permitting all sorts of promoters to find financing for all kinds of projects.[126] The crowdfunding is made possible by technology through online platforms offering its contributors new communication means and a model simplifying the capital-raising process.[127] Also, crowdfunding establishes a market connecting directly the funders with the promoters of projects, thus eliminating the requirement for intermediaries such as banks or venture capitalists. Of course, the online platform is required for obtaining funds comparatively simply, efficiently and quickly.[128] Crowdlending is known as peer-to-peer lending (P2P) or peer-to-business lending (P2B), and capital is obtained directly from the original source of funds rather than from a third party. It is characteristic that while P2Bs' capability to directly connect investors and corporate borrowers relieves them from the requirement to hold costly regulatory capital, it subjects them to the impact of liquidity shocks. On the other hand, banks' liquid inventories permit them to bridge funding gaps, but at the cost of subjecting them to credit risks and the resulting regulatory oversight, involving capital requirements. In other words, the variety in designs used in the P2B industry, along with the alterations that have taken place in Funding Circle, reveals that the financial industry is still in a stage of experimentation.

Crowdlending is a part of the FinTech "revolution" disintermediating financial services. It has to be taken into consideration that the P2P/P2B online lending platforms have challenged traditional banks and intermediaries by presenting more cost-efficient offerings as a result of the scaling of the newly adopted technologies, and so, these services tender higher returns for lenders and lower interest rate costs for borrowers.[129] It could be said that P2P platforms are closely bank substitutes serving the same borrowers.[130] Also, the platforms do not take credit risks but rather decentralize these by spreading them to the crowdlenders. It could be said that peer-to-peer (P2P) lending substitutes bank loans, having negative influence on national bank loan balances when P2P lending balances is big.[131]

In other words, crowdfunding implicates the financing of projects by large numbers of people via digital platforms serving as electronic marketplaces, which means that peer-to-peer (P2P) lending is one of the two main methods of for-profit crowdfunding. The other method is equity crowdfunding, where early-stage ventures raise outside equity from the crowd via digital platforms. Additionally, P2P lending involves the crowd and financial institutions funding loans to small businesses or to consumers.[132]

It has to be taken into account that market participants have articulated fear regarding the cost and complexity of relying on Regulation Crowdfunding encompassing disclosure regulations.[133] Crowdfunding presents an equivalent situation to ICOs in that it also implicates selling risky investments to unaccredited investors through general solicitation. ICOs present high levels of information asymmetry between developers and coin buyers, both in terms of a coin's newness and its inspiring blockchain technology. Nonetheless, crowdfunding disclosures have been inefficient and unread by most investors.[134] Thus, disclosures reduce information asymmetry ex ante and permit fraud enforcement ex post.[135]

P2P marketplaces provide two novel sources of external debt finance; on one hand, P2P business loans offer medium-term finance for maturities of up to five years, and on the other, invoice finance presents short-term asset-backed loans with up to one-year maturity. Moreover, P2P or marketplace lending diverges from bank lending since it is funded via a cyberspace portal and is not being subject to Basel III and other formal banking regulations, constituting a unique method of outside entrepreneurial finance.[136] In line with this, Jerry Coakley and Winifred Huang[137] argue that

> "the success of the P2P business lending market stems from the symbiotic relationship between financial institutions and small investors as the lenders. The former exploits the collective wisdom of the crowd while the latter views large institutional investments as a certification effect that reduces information asymmetries and sometimes herds in their wake."

It has to be taken into account that the fintech platforms have advanced the lending process by rendering the P2P lending and microloans that adjust to the borrower's wishes. Moreover, different P2P lending platforms utilize the latest technology in credit risk assessment and lending suitability, allowing them to present fitting solutions.[138]

Online lending platforms by directly connecting retail lenders with corporate or consumer borrowers have been believed to be a new model of credit finance: decentralized, transparent, disintermediated, and more information-efficient. On the other hand, Julian Franks et al.[139] argue that "the main problem of the platform was its vulnerability to liquidity shocks, resulting in sizable deviations from information efficiency. These increased over time due to a growing role played by non-crowd players, particularly large investors and algorithms."

Has the right to print conventional money been utilized for conquering the globe by an elite? Will cryptocurrencies and tokenization be the new tools for expanding old elite colonization of the globe? Is the supposed decentralized crypto a veil in order to eventually control the printing and circulation of money according to the interests of the same old elite? Taking into account that any digital money facilitates fast, seamless, and around-the-clock transactions between consumers and corporations, the tokenization of the financial system will implicate a complementary relationship between digital public money, like CBDCs, and other forms of digital private money. CBDC is a device for central banks to maintain stability within the digital realm, essentially tackling the limitations of traditional forms of money.[140]

It seems that tokenization is transforming how money better serves financial demands and, as a result, it generates new openings for consumers and corporations to transact in new spaces and new methods which means opening new paths for wider inter-industry settlements, assisting financial inclusion, empowering seamless cross-border transactions, and finally boosting the competence of capital markets.

It is characteristic that DeFi has made it possible to cut transaction costs, promote wider financial inclusion, enable open access, increase transparency, tolerate

borderless finance, and generating new opportunities for entrepreneurs and innovators. Consequently, DeFi has advanced finance via a financial system without borders, jurisdiction, and centralized control, while raising significant challenges and threats to financial stability.[141] Decentralized finance, or DeFi, replicates financial services with smart contracts over blockchains, and so DeFi operates as money "Legos"[142] which means that cryptocurrencies are a tradable financial product representing a digital asset acting as a digital form of money.

1.11 Data and Finance

Advances in AI systems generate a variety of smart connected products and services, software, data analytics, and connectivity.[143] Big data allows for information handling, and so, predictive analytics tools that control data volume, velocity, and variety are utilized. Additionally, the explosion of digital data is critical, as by using big data, managers can measure and grasp more insight into their corporation and directly translate that knowledge into enhanced decision-making and performance.[144]

AI has the ability to accurately interpret external data, to learn from such data, and to use those learnings to accomplish particular objectives and tasks through flexible adjustments. Additionally, AI concentrates on financial detection and intrusion detection systems in data networks through data mining techniques and neural networks.

Does AI monetize data? It has to be taken into consideration that monetizing collected data is a revenue source for large corporations, such as Facebook and Google. Huge data footprints are aggregated and ultimately exploited to cross-sell and upsell products to customers which means that data is valuable. The scale of automation has enriched the industrial corporations with more intelligent and self-adaptive improvements are made through AI. AI software is creating unnoticed business prospects and societal values, with even smarter chat bots offering expert assistance and robot advisors conducting direct research in many fields.

It is argued that learning algorithms and big data, in combination with human creativity, assist organizations in optimizing their business and better predicting and controlling their processes and applications.[145] Hence, corporate information is collected, shared, and enriched via co-creative computational systems and assistive technologies that augment human capabilities and productivity. Are AAI humanoids the intermediator/intermediary between humans and machines? At the moment, AI systems are used by humans in order to advance any business process, but AAI humanoids will be able to control the entire economic process without any human involvement. It is supposed that AAI humanoids will not be the new deadly weapon in the hands of the old elite in order to govern the globe once again.

It has to be taken into consideration that data explosion is the central driver of technological innovation, and so, corporations in order to handle large volumes of data, exploit cloud where the participating corporations host their applications and data by utilizing machine learning algorithms.[146] It seems that new technologies generate new problems due to their function, and so, a new technology comes to

solve the problem, which means that AI technology has to be effective in solving any malfunction of the technology and not merely a new technology required to address its application consequences and problems due to its function. On the other hand, AAI technology will deal with all the problems caused by its function and offes solution directly, not requiring a new technology to solve its misapplications.

1.12 Digital Financial Services

It has to be taken into consideration that the rapid growth of digital financial services (DFS) has had a transformative impact on the finance of corporations.[147] Julian Gruin[148] specifies that "the rise of Chinese fintech represents more than a market-based utilization of new financial technologies in response to an entrenched state-dominated banking system, but rather constitutes an important institutional foundation in the ongoing construction of an authoritarian capitalist system."

China has resisted the limitations of globalized finance, but it endorsed an acculturated set of strategies to both incorporate and constrain the power of global financial integration in order to avert macroeconomic risks. Additionally, the political economy of Chinese fintech encompasses many dynamics of change within the financial system, leading to the transformation of social and economic governance structures.[149]

Financialization utilizes the increasing importance of financial markets, motives, institutions, and elites in the operation of the economy and its governing institutions. As a result, Chinese firms are becoming financialized, accentuating contact with global professional service corporations and "best practices" in human resource management and corporate governance. Moreover, human resource management now involves the incorporation of AI devices tracking productivity rates and producing warnings to employees concerning productivity delays.[150]

Online lending and the rise of digital credit scoring are enabling shifts in China's model of growth and development, thus empowering the development of new digital economies and markets which means that the role of finance and the banking system in China's economic reform and development has played a central role. Additionally, the rise of DFS as a foundation for inclusive financial liberalization denotes a noteworthy move in the socio-economic reach of the Chinese financial system, along with newly shaped financial networks and relationships.

In other words, there is a move from the traditional network of commercial banks to those overseeing and exploiting the infrastructure of digital finance itself, and so, databases and data-processing techniques are embraced. Hence, the rise of Chinese DFS establishes a digital financialization process embedding technological innovation within the distinctive political economy of China and exploiting big data technologies, an economic growth model necessitating a competent financial system and a retail market environment for digital financial services that maximizes new openings for socio-economic development while minimizing interconnected threats to systemic stability. On the other hand, digital financialization is generating new instruments for the Chinese government to supervise both individual and corporate players and employing algorithmic systems.[151]

1.13 CBDCs and Global Finance

Private cryptocurrencies and the upcoming CBDC lead to greater currency competition, generating regulatory complexities. There is a global drive to advance the efficiency of cross-border payments. CBDCs are a digital form of fiat money issued by a central bank, and currency substitution diminishes monetary authorities' control over national liquidity by limiting the component over which the authorities have direct influence. Hence, substitution into CBDCs is no different from conventional "dollarization" taking place in countries that have experienced high inflation and large exchange rate volatility. Therefore, the convenience and easier accessibility of CBDCs facilitate substitution at a faster pace and larger scale. It could be said that the CBDC could augment the degree of currency substitution in states that already use a foreign currency, which means that CBDCs could permit superior control of capital flows, depending on how they are planned and the degree of cooperation between the issuer and recipient state.

The increasing approval of CBDCs stems from numerous factors,[152] but their widespread implementation and prospective implications have introduced concerns regarding the future global financial system. Consequently, the present financial background is certifying an unprecedented divergence. As more CBDCs circulate in the global market, the increased cybersecurity risk and high monetary mobility would have an effect on financial stability. CBDCs generate cybersecurity concerns that vary from those in the current digital financial system covering centralised financial data, problems with regulatory agencies, augmented complexity in client key custody, dependence on the integrity of third-party validators along with difficulty in transaction cancellation, and the prospective for intensified errors in scope and scale as a result of programmable transactions.[153]

Furthermore, CBDCs vest central banks with notable capability to control monetary policies as they will have abundant data about countrywide transactions, but such a data-collecting-and-analyzing practice would subject central banks to a noteworthy privacy invasion concern.[154] Hence, cross-border transactions will compel the regulatory necessities for CBDC security. Thus, the global AML/CFT requirements for CBDC will concentrate on the interoperability of different CBDC systems and the capability to trace money flaws through financial intermediaries.

It has to be taken into account that the circulation of different CBDCs in the global financial network will necessitate central banks to prepare new rules. Cheng-Yun, Tsang, and Ping-Kuei Chen[155] argue that "Geopolitical concerns on currency sovereignty and competition over fintech innovations can simultaneously encourage cooperation and confrontation. The central banks, financial intermediaries, and private sector should be ready to cope with significant changes in the global financial order."

It has to be taken into account that the nature and pace of technological development are altering the face of globalization and underlining that trade in nonmaterial goods is subject to rapid technological innovation via distributed ledger technology. Hence, the digitization of trade in goods and services encompasses the implementation of widespread automated contracts, and so, the future launch of

CBDCs for such cross-border payment transactions further stimulates the utilization of automated contracts.

Digitalization simplifies cross-border use of currencies, restructuring the demand for and supply of safe assets. Moreover, in terms of demand, an unequal rate of technological innovations across states or currency blocs, the appearance of alternative cross-border payment "rails," or a transition to financial intermediation designated in a CBDC or global stablecoin could shift reserve currencies. In addition, in terms of supply, new digital platforms could emerge and reach a global scale, presenting alternative networks that CBDCs may tap into with the purpose of stimulating adoption upon issuance. Furthermore, CBDCs boost domestic payment systems by generating security and transparency within the monetary system, reducing the risks of fraud and money laundering, which means that augmenting transparency in the flow of money contributes to lowering currency substitution.

It has to be taken into account that in the area of global finance, technological advancement alters the interacting dynamics among states and, as a result, the appearance of fintech has boosted certain countries to the forefront of global financial centers. However, presently the competition among fintech centers has not altered the global financial order. Concerning technology functioning within a jurisdiction, Przemysław Pałka[156] argues that "there is always a political decision taken. Regardless of whether it occurs explicitly through legislation, or implicitly, by leaving the decision to the market, and allowing corporations to write their own rules, some decision occurs." On the other hand, CBDCs are deeply interlinked with global monetary territory and circulation, having the prospective to redirect global capital flows when they become prevalent, not mentioning the administration of banking by AAI technology functioning entirely on objectively technical terms without any political intervention will generate new financial centers grounded on the level of AAI technology utilized in various parts of the globe.

The rise of CBDCs is driven by technological developments in addition to geo-financial concerns.[157] Moreover, technological evolution and geo-financial inferences supplemented extra complexity to the present global financial order, restructuring the order. To that extent, countries are at different phases of financial market development, and so, the interacting dynamics between cryptocurrency and fiat currency remain unresolved by many sovereigns. In line with this, Cheng-Yun, Tsang, and Ping-Kuei Chen[158] argue that

> "States might utilize CBDCs to fine-tune their monetary policy or even enable new forms of surveillance capitalism. To present a balanced view, we also highlighted that harmonization could be driven by factors such as central banks' emphasis on the importance of smooth cross border transactions, the enforcement of AML/CFT rules, and the desire to achieve a more stable financial system…CBDC is much more than a means of exchanging commodities and services. Developing CBDCs is hardly a domestic matter, especially for major global economies. Once a major economy launches CBDC and circulates globally, it will soon imply global financial governance."

It has to be taken into consideration that the CBDC will compete with bank deposits in the market for digital money, which means that the CBDC will crowd out bank deposits, undermining financial stability by lifting the funding cost and diminishing the profitability of the banking sector. Hence, the CBDC escalates the deposit demand elasticity with regard to the deposit rate because households now have more options.[159]

Taking into account that CBDC will have official government money status, CBDC will become a critical alternative to cash or bank credit. CBDC amplifies deposit spreads in this case, making more depositors choose shadow banks rather than commercial banks. Moreover, loan origination moves toward shadow banks, which are gaining share in a reducing market; thus, transferring loans to shadow banks will cause a critical allocation of credit risk in a rather vulnerable and unregulated part of the financial system. To that extent, Dmitry Oskolkov[160] argues that

> "CBDC is shown to neutralize shadow monetary transmission channel when banks are unconstrained. While deposit spread increases in government bond interest rate, it declines in CBDC rate…increase in CBDC interest rate can act in the opposite manner to increase in government bond rate. This indicates that CBDC rate can become a useful instrument for monetary policy conduction…Firms face increasing loan rates when CBDC rate grows, but pay less taxes when CBDC rate is not big."

Owing to its digital and centralized nature, CBDC is programmable, and those who govern the infrastructure can alter its qualities, which means that a central bank can adjust the interest rates, holding limits, and employing restrictions. Moreover, due to their quality, both data and financial assets flow around the globe and have a cross-border character. Also, the success of CBDC for cross-border transactions depends on the access and interoperability selections made by central banks; therefore, technological and legal interoperability is central to CBDC's success, which means that a workable legal framework is needed for the establishment of a stable financial market infrastructure.

CBDC networks generate increased currency competition and so, CBDC networks possibly instigate the risk of increased uncertainties.[161] On the other hand, the decentralized structures make it hard to instigate strong governance measures to stabilize the interchange mechanisms and the digital identity frameworks. Nonetheless, CBDC networks advance financial inclusion.[162] Hence, CBDC will augment central banks' effectiveness in conducting monetary policy operations.[163]

It is worth noting that access to cash remains vital to the public since it is their only alternative to commercial bank money, an alternative that becomes vital in times of distress for the banking sector. To that extent, CBDC will permit central banks to promote further reductions in cash usage.[164]

As discussed earlier, E-money refers to an "electronic store" of monetary value on a technical device utilized for making payments.[165] Transformations in money have been driven by new technology and preferences, economic growth, and the need to fulfill socioeconomic change. Moreover, digital money, unlike e-money,

has no parallel physical embodiment functioning in a technological environment. A digital and particularly a tokenized system presents advantages over an electronic system, and so, payments can be unified, reducing the costs linked with intermediaries.

It is characteristic that increased payment transparency diminishes money laundering and tax evasion. It must be taken into account that a common concern about CBDC is that transparency lessens tax evasion and money laundering, but, on the other hand, it presents risks to privacy and the misuse of the extraordinary new transactional data being generated and recorded in almost immediate reconciled time. Thus, digital currencies entail extremely sound and transparent economic governance by central banks, and very transparent systems for controlling and retrieving the resulting new economic data.[166]

Retail CBDCs are seen as digital versions of fiat money driven by the need to maintain the effectiveness of monetary policy, while the use of cash declines and interest in private money flourishes, there is a desire of advancing transaction efficiency and so improving accessibility and financial inclusion.[167] Also, CBDCs function as both a medium of exchange and a store of value, coexisting with other forms of central bank money and with commercial bank and e-money which means that CBDCs will serve as a up-to-date counterpart to physical cash.[168]It seems that CBDCs systems' design is the capacity to conduct transactions even without network connectivity[169] and so, Offline CBDC transactions will ensure access to payment functionalities in the absence of a reliable network connection or for the period of broader system failures.[170] It is impractical to preserve anonymity if a CBDC is issued, and the public nature of a CBDC would place it at the top of the financial pyramid. In this context, P. Michalopoulos et al.[171] argue that "offline CBDC transactions with existing hardware and software technology solutions introduce additional degrees of flexibility to privacy-related designs that can even emulate the privacy features of physical cash."

1.14 ChatGPT and Finance

ChatGPT is transforming traditional processes while causing unique challenges, and in finance, ChatGPT restructures customer interactions by advancing personalized financial advice, supporting investment strategies, and accelerating real-time market analysis. Hence, ChatGPT processes huge data speedily, boosting algorithmic trading, risk management, and fraud detection. Also, in accounting, AI systems automate data entry, categorization, and report generation, reducing human errors and operational costs and paving the road for supporting forensic accounting techniques. Nonetheless, ChatGPT and AI in finance and accounting are posing ethical dilemmas regarding data privacy, security, and biased decision-making algorithms, which means that there is a need to make certain that AI systems adhere to industry standards and regulations while preserving the integrity and confidentiality of sensitive financial data. Data security is crucial, and strong cybersecurity measures protect sensitive financial data. In other words, in finance, ChatGPT can present personalized financial advice and support investment strategies by enabling

real-time market analysis. Additionally, ChatGPT can handle big data promptly, manage risk, detect fraud, and enhance algorithmic trading. Rane, Nitin[172] argues that

> "While ChatGPT can analyze data and offer insights, final decisions in finance often carry profound implications. Striking the right balance between human judgment and AI-driven recommendations is vital to avoid excessive reliance on automated systems, ensuring that human expertise remains central in critical financial decisions."

It has to be taken into account that there are concerns about the accountability of AI-driven financial decisions, necessitating a balance between human expertise and machine intelligence. Furthermore, the constant advancement of financial markets requires adaptability and continuous learning from AI systems.

ChatGPT has brought effectiveness, accuracy, and innovation, transforming the financial industry by processing vast datasets, automating tasks, and presenting valuable insights. Processes such as data entry, reconciliation, and financial analysis are streamlined, which means empowering finance authorities to concentrate on strategic decision-making.[173] To that extent, AI-powered chatbots boost customer service, guaranteeing real-time query resolution.

It is worth noting that financial reporting encompassing budgeting and cost analysis follows accounting standards, gains from AI automation, certifying accuracy and compliance. Moreover, there is a demand for transparency in AI algorithms guaranteeing that decisions made by AI systems are explainable and unbiased. Also, AI assists strategic planning via systematic analysis of financial records and so maintaining financial integrity. In line with this, Rane, Nitin[174] argues that "ChatGPT can indeed catalyze positive change, propelling the finance and accounting industries toward a future marked by efficiency, accuracy, and ethical excellence."

In addition, taxation gains from AI computation ensure compliance with changing laws. Moreover, regulatory compliance necessitates aligning AI with many financial regulations.

1.15 Blockchain and AI in Finance

It has to be taken into consideration that the convergence of blockchain technology and AI is steering in a new age of security and transparency within the financial sector, which means that this mixture forwards critical encounters faced by conventional financial systems while also displaying inventive solutions to enhance efficiency, minimize fraud, and strengthen transparency. Blockchain has to make certain that once data is recorded, it remains unaffected by modification, thus delivering an unparalleled level of security that seems to be challenged by new technologies. Therefore, blockchain must become an ideal choice for reinforcing financial systems against cyber threats and fraudulent activities. On the other hand, AI contributes predictive analytics and automation to the forefront of financial operations,

enabling real-time data analysis, risk assessment, and decision-making, heightening processes and uplifting overall effectiveness. Thus, blockchain in tandem with AI should boost the precision and dependability of financial data, fostering a more secure and transparent ecosystem. To that extent, Rane, Nitin et al.[175] argue that

> "the transparency ushered in by Blockchain ensures that all stakeholders have access to a singular version of the truth, fostering trust in financial transactions. Furthermore, the incorporation of AI in fraud detection and risk management heightens the proactive identification of potential threats, safeguarding financial institutions and their clientele.

It is characteristic that GNN-based fraud detection models must adhere to AML, KYC, and GDPR regulations, which means that fraud detection systems must be transparent and auditable.

In other words, the merging of blockchain and AI technologies is triggering a substantial modification in the financial landscape, and so, financial transactions and data move globally quickly, demanding a secure and transparent financial ecosystem. In line with this, Rane, Nitin et al.[176] say that

> "Beyond security and transparency, the integration of Blockchain and AI redefines the nature of financial interactions. Smart contracts, powered by Blockchain, automate and enforce agreements without intermediaries, expediting processes and reducing the risk of disputes. AI-driven robo-advisors and personalized financial services leverage predictive analytics to offer tailored recommendations, enhancing customer experiences and financial outcomes."

1.16 EU AI Act and Finance

The EU AI Act advances the embracing of AI systems in the EU by designing a legal framework that offsets the economic opportunities generated by AI with the demand to tackle the risks that the use of AI produces in terms of protecting public values[177] and the rule of law.[178] Moreover, the act relies on an ex-ante assessment by the lawmaker of the risks linked with some AI technologies. Additionally, Article 10(5) establishes a new legal basis for processing sensitive personal data on the basis that existing rules under EU data protection law were not enough to permit measures to diminish prospective biases in data utilized to train algorithms in high-risk contexts. Thus, the EU AI Act reveals a range of compromises and trade-offs.[179]

It has to be taken into account that the EU AI Act applies horizontally and its horizontality means all domains covered by EU law, and so, AI systems used by financial institutions[180] and by the financial sector are covered by the Act which means that systems used to evaluate creditworthiness, credit scores, and risk assessments fall into the high-risk category. Hence, the EU AI Act integrates its new obligations into standing procedures for financial supervision.[181] In addition,

the EU AI Act promotes the use of AI while preserving public values and forcing national authorities to adopt measures to support innovation. To that extent, Marco Almada[182] argues that

> "In order to carry out their duties in the age of AI, financial supervisory authorities need to develop additional capabilities. They need to foster technical competencies in AI, and the legal expertise required to navigate risks to fundamental rights that fall outside their traditional remit."

It is characteristic that the EU AI Act[183] initiates a new category of AI systems named GPAI models, exposing considerable generality, but they accomplish a wide range of missions by prioritizing transparency and accountability and so, presenting technical documentation, instructions for use, and revealing training data while respecting copyright, which means lessening prospective risks and advancing trust within the AI society.[184] Furthermore, the EU AI Act states that institutions are subject to governance prerequisites and processes under EU financial law, thus accomplishing certain obligations defined in the regulation, subject to particular provisions regarding risk management and market monitoring. In fact, financial institutions have to keep documentation under EU law on financial services.[185] Besides, Kilian, Robert[186] et al. argue that

> "the EU risks creating an uneven playing field that could significantly hinder innovation in the European AI ecosystem. Additionally, the amount and complexity of technical standards considered or developed as standardization deliverables should be reduced to make them more practicable."

Furthermore, the EU AI Act endorses regulatory frameworks to keep pace with technological advancements, and the risks linked with GPAI systems extend far beyond the narrow alarms of data quality and bias encompassing copyright violations, the misuse of AI-generated content, the creation of deepfakes, and the range of misinformation and disinformation utilized in creating highly realistic fake images and videos, setting contests for regulators due to the difficulties in distinguishing between human and synthetic content, particularly when it is distributed at scale.

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2 AI, Crypto Assets, and Financial Markets

2.1 Introduction

Globalization brings a reduction in the barriers—whether technological or legislative—to economic exchanges between countries. Moreover, globalization brings the gradual integration of economies and societies driven by novel technologies, new economic interaction, and interrelation among the national and international policies of various players such as governments, international organizations, business, labor, and civil society. Hence, globalization increased the cross-border flow of capital, goods, services, and information.

Both domestic and cross-border M&A deals are susceptible to insider trading for the reason that acquirers traditionally pay a large premium for target stocks. Thus, traders who acquire target stocks or call options before the public announcement of a deal often stand to earn large profits upon the announcement. Hence, in a cross-border M&A, from the target country regulators' standpoint, insiders linked with the foreign acquirer are mostly residents of foreign jurisdictions, which means that for these foreign insiders, while their illegal trades take part in the target country's market, the crucial evidence required for prosecuting them is in most cases not under the control of the target country authorities. Thus, an executive in the acquirer can easily tip a friend regarding the forthcoming cross-border M&A deal. To that extent, Guo, Lixiong, and Zhang, Sherry[1]

> find that "cross-border deals involving acquirers from countries with weak legal institutions, more acceptance of cheating on taxes, and high corruption are associated with greater intensity of insider trading. This provides further evidence that some of the trades on the target country's financial market are driven by inside information leaked from foreign acquirers."

Finance is vital for strong entrepreneurship and, subsequently, constraints on finance have an impact. Also, finance holds back the opening of markets along both supply and demand lines through its influence on the growth of fixed-cost investments such as infrastructure.

The financial markets have enlarged and altered significantly owing to enhancement in technology and the ever-altering regulatory and social environment. Moreover, there has been a spread of financial notions, instruments, and tools because of augmented computing power and immediate information sharing

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through networks. Hence, the globalization of businesses and economies continues to affect the field of finance, and so, in an AI economy, investors foresee information shifts by adapting their portfolios to defend against these shifts.

Advances in digitization and information technology have profoundly altered and transformed the financial industry; as a result, traditional financial institutions and banks are losing their sovereignty as new market entrants and emerging technologies replace or substitute their part as financial intermediaries.

2.2 Digitalization

First of all, digital technologies have spread into economic activity, altering production patterns via automation and consumption patterns via increasingly digital platforms. Moreover, the principle of digital technology is the "binary-digits" setup for storing information and encompassing processing, storage, and exchange of data. It is worth mentioning here that the ongoing digitalization is leading to rapid transformations in the whole structure of the global economy.[2] Two driving forces are obvious: firstly, digital platforms as a dominant business model, and second, an expanding role for intangible inputs such as data and software. Hence, digitalization has caused the transformation of the global economy into the digital economy. Thus, further than the control of the economy by digital platforms, an augmented function for intangible inputs such as data and software is a quality of the digital economy which means that by bringing forth noteworthy scale economies with amplified fixed costs and diminished marginal costs benefitting large corporations[3] are offering a competitive edge for early technology adopters. On the other hand, digitalization enhances productivity in the short run by deterring entry by new companies, leading to lower growth in the long run.[4] To that extent, S. Abis and L. Veldkamp[5] find that a considerable transformation in the production function has taken place, and the adoption of AI and big data technologies, along with the collection of stocks of data, diverges broadly in corporations' manufacturing progress.

It could be said that digital technology allows developing countries to augment economic growth and thus reduce the difference with developed countries by enabling them to go beyond physical constraints in infrastructure, which means boosting integration and stimulating national competitiveness globally. In line with this, Thuy Linh Cao and Judy Hsu[6] argue that "digitalization can even effectively reduce the detrimental effects of geographic and religion gap on exports. Besides, digitalization is also seen to help countries overcome language, administration, and economic gaps to promote export activities."

Digital technology has let corporations to boost their product and service reach globally, capturing opportunities to augment operational effectiveness, including managing productivity and customer relationship management (CRM).[7] Moreover, the integration of AI technologies into international business practices is indispensable for corporations to remain competitive, which means that corporations have to adapt to and acclimatize in the AI global landscape.

Digital transformations change microeconomic allocation via the electronic functioning of markets and macroeconomic outcomes, generating alterations in

integration and globalization. Moreover, digitalization has fallout effects on modern economies and societies, such as notable savings in costs.[8] It seems that current digitalization has not been transforming the central laws of economics but has activated alterations concerning agents' interaction in the market. To that extent, V. Labhard and J. Lehtimäki[9] suggest that

> "better institutions and governance tend to be associated with greater growth-enhancing effects from digital technologies…while technology has historically had a growth-enhancing effect, the absence or presence of established and high-quality societal environment can help in amplifying the potential growth effects".

While digital technologies influence sectors in different ways, they generate productivity gains at the corporate level, with more productive corporations being more digital.[10] To that extent, digitalization generates digital goods and services.

It has to be taken into consideration that information facilitation and management have a central role in market running, demanding the cooperation of public and private sectors. To that extent, Salomé Viljoen[11] argues that

> "the market machine mechanisms deployed in digital platforms both vex and challenge these practices, exposing contradictions between digital markets and the grounding theories that justify market deference. Yet this contradiction presents not only a regulatory challenge, but an opportunity to consider how informationalism beyond managerialism may be put toward a different regulatory approach and help to realize a different set of allocative goals and governing institutions".

Hence, information procedures allow digital platforms to adjust prices to their benefit, but on the other hand, high-quality public data permit institutional designs that transfer power toward community control.

It is distinctive that digital technologies are very general, applying all over the economy and activities. Moreover, digital technologies have characteristics that make them more authoritative than other technologies, making them more difficult to fully take advantage of. Additionally, the significance of most new technologies comes from the fact that they spread across many different users and uses. Is there an interplay of digital technologies with institutions and governance? Institutions play a significant part in forming modern economies, being crucial drivers of growth.[12] Hence, digitalization, institutions, and governance stipulate openings to economic agents regarding information access, a framework for market transactions, and by permitting enforcement. In other words, digitalization by utilizing AI systems allows the SEC to spot and prevent insider trading.

It is worth mentioning here that even though digitalization is regarded as a massive game changer that would accelerate corporations' productivity and produce value for the economy as a whole, this has not transpired yet. Robert Anderton et al.[13] show that

> "digitalisation tends to have on average a positive impact on firm level productivity growth. However, it does not seem to be either a massive gamechanger or a "one-size-fits-all" strategy that manage to deliver productivity gains to all firms alike. The impact of digitalisation on the average firm's TFP growth is relatively small and we find that most firms are not able to benefit from digitalisation at all…intangible assets are closely linked with digital technologies and act as a complement to digitalisation to magnify its positive impact on the average firm's TFP growth."

Hence, the transition to a digital economy has been verified as a precedence by policymakers and international institutions and so implementing numerous policies in order to speed up digital adoption and in that way enhancing productivity.[14]

It could be said that corporations only in some areas benefit on average from investing in digital technologies, which means that digitalization is a game changer only for corporations implementing digital technologies to become considerably more productive over time. Hence, a higher digital investment by itself is not turning highly productive "laggards" into frontier corporations, which means that corporation's surface at the top of the productivity distribution is achieved via a more structural innovation strategy and not directly after an increase in digital investment. Also, it could be said that policies that incentivize corporations to become more digital over time should be constructed in a manner assisting "laggard" companies to fully reap the productivity returns from higher digital investments on a case-by-case basis, and so corporations must implement new digital technologies under unique conditions in their daily operations.[15] To that extent, investment treaties grant protections and incentives to foreign investors, allowing them to pursue remedies if they consider these provisions have been breached.

It has to be taken into consideration that digitalization boosts the effectiveness of information collection, storage, and exchange, making possible the collection and processing of information in a fully automated way. Moreover, digitalization permits storing large amounts of detailed data and relies on a fully automated data exchange, and so, digitalization generates economies of scale and network consequences, shaping the economic basis for the speedy advancement of platforms. Hence, digitalization produces room for new products and services, such as e-books or personalized items, thus advancing not only the efficiency of inventory flows but also tracking and recognizing customers. Thus, digitalization generates the processing of information in a fully automated manner, such as analyzing data by AI, permitting a fully automated data exchange between market participants or members of the value chain, boosting the evolution of platforms. In addition, personalized advertising augments consumer choice by lowering advertising costs and permitting new entrants to market their products without a massive high marketing cost,[16] which means that personalized ad-based monetization permits apps to advance "high-quality services to consumers for free."[17]

It is worth noting that the new players are cloud operators in industries with a significant digital goods or services component, gaining deep insight into their cloud users' needs and business models, creating another channel for insider

trading. On the other hand, AAI digitalization will alter the whole concept of material life on earth grounded on the rationale of introducing AAI humanoids consuming a particular kind of energy, which might alter the global production unless AAI humanoids have the same feeding demands as humans. This means that the laws of conventional economics will apply to the AAI economy as well, differentiating only in the tools of implementation.

It has to be taken into account that the consequences of digitalization on the manufacturing area, where digital means play a less direct role, vary considerably from their influence on traditional services or digital products, which could gain the most from digitalization and thus expose noteworthy disparities in how digital transformation remodels global trade.[18]

2.3 Centralization versus Decentralization

Centralization encompasses the central bureaucratic decision-making that most businesses undertake, and second a centralized ledger records all data, information, and transactions such as a corporation's assets, liabilities, costs, and revenue. From an organizational standpoint, centralization applies to government structures and at the core of corporations, which means that users have no control over the single decision-maker running centralized systems, resulting in possible censorship. The best possible level of decentralization necessitates balancing the costs of poor decisions owing to poor information and those arising from goal incongruence which means that deciding on the optimal level of decentralization implicates a trade-off between coordination and adaptation.

It is characteristic that the world is becoming centralized and so gradually is controlled by a few MNEs to the impairment of the many. On the other hand, decentralization offers more effective management in the financial sector, greater privacy protection, and fairer interfaces between the public sector, private sector, and people domain which means putting humans at the center of decision-making. Also, due to globalization and access to technologies, more and more interfaces between the public sector, the private sector, and people have become digitized, and so, digitalization connects people, businesses, and states empowering access to public goods, generating digital identity, and improving financial dealings via cyberspace and AI systems, which means that e-commerce and social media link people everywhere. In other words, the capability to digitally interconnect and share information is enabled by cyberspace and AI space.

It is worth noting that cyberspace became centralized in many ways, and so, cyberspace supposed to be decentralized. In the end the wish of states to control information led to the centralization of cyberspace.[19] Hence, following the centralization of cyberspace, there is a tendency toward digitized decentralization of finance and money, which in the end will be centralized via new technologies and controlled by a few corporations and governments as well. To that extent, the arrival of Bitcoin and the "decentralized finance" or DeFi establish a type of decentralization allowing the exchange of value without the risk of requiring to face up to a single intermediary. Despite that the Bitcoin system started as decentralized, it

seems that the Bitcoin system has been displaying escalating signs of control and centralization.

A certain picture of centralization is money. Money, of the fiat kind, like bank notes and coins, is issued by the central bank of a country in a centralized manner and backed by and supported by that central bank and its centralized government. Moreover, in a centralized system, a single decision-maker or central authority is realized. To that extent, cyberspace has been centralized at the commercial and organizational level and so, digital platforms utilizing AI systems have become near monopolies in their given area of functionality and there has been a concentration of ownership in the organizers of connectivity rather than providers of specific functionality. In addition, hardware ownership and management are centralized by cloud providers along with the utility software embracing operating systems and databases.

Are governance and decision-making crucial elements in appraising whether a system is centralized or decentralized? A system with fully decentralized decision-making implies the absence of any form of influence, power, or control over developers or contributors. Taking into consideration that decentralization runs on and within a spectrum, a system is decentralized for the reason that there is no central decision-maker or authority; however, a decentralized system can be more or less decentralized than another system based on the fact that various variables and factors appear internally and externally within and around a system, influencing the interaction with any other system on social, political, technological, and legal matters.

It has to be taken into account that the emergence of cryptocurrencies and the decentralized finance or DeFi are responses to centralization. Decentralized finance comprises widespread networks of open source, but not all systems are decentralized across all dimensions. However, they have altered the understanding of how digital systems operate, introducing new methods of authentication that are more automated than those of central governmental authorities, big banks, giant payment service providers, or social media corporations. Digital networks require no enrollment at all, and the databases that they utilize do not sit on that corporation's servers. There is a fast-changing and technologically driven world due to the fact that everything is digitized and is becoming smart through the use of data, which denotes more and more digital representations of things, like land titles, currency, commodities, and contracts that are recorded, exchanged, and stored digitally. Cloud computing is a centralized phenomenon, and thus, the Cloud is an example of centralization in action. It is characteristic that decentralized finance has not yet reached its full potential as a result of several challenges linked to fraud, volatility, usability, and regulatory uncertainty. Therefore, an AAI system controlling and correcting directly any deficiencies in the whole process will solve the ineffectiveness of present decentralized finance models.

It is argued that the capacity to transfer money across borders in a safe and secure manner is a prerequisite for the global economy. The prospective advantages of Central Bank Digital Currencies (CBDCs) in progressing financial stability, establishing financial inclusion, and boosting the competence and resilience

of payments have been achieved owing to the declining use of physical cash, and so, CBDCs are turning out to be a geopolitically strategic priority and even confronting the supremacy of the US dollar.[20] Financial inclusion is the competence of people and corporations to have effective access to a wide range of appropriate financial services. Financial inclusion and access to credit are factors in accomplishing financial sustainability.

It is stipulated that central banks must reexamine their role as money issuers[21] in the digital age. Thus, central bank digital cash is a way of upholding financial stability and limiting the mass-privatization of money, which will generate problems of trust and the quantity of money circulating in the markets which means inevitably problems of inflation and real growth.

The responsibility to manage and preserve the value of currency is not the same as the responsibility to manage and administer transactions, and the responsibility to supervise payment systems is not the same as the responsibility to run them. Hence, the management of a transactional infrastructure supporting CBDC is not antagonistic to the operational responsibility of a central bank in using CBDCs to produce money and carry out monetary policy. The European Central Bank sees that CBDC could be an alternative to euro banknotes and could complement cash by serving as "an electronic means of payment that anyone could use in the euro area."[22] IMF regards CBDC as a new kind of money serving as legal tender. Having a more decentralized governance and running distributed ledger technologies (DLTs) allow participants to better compete and innovate and possibly offer better and more added value to end-users and customers. To that extent, Eddie Yue[23] highlights the "need a holistic digital money framework that will facilitate the healthy co-existence of public and private money to support our future digital economy."

As the concept of centralization compares to the concentration of power and control, decentralized finance or DeFi is a new mode of operating financial services with the concept of decentralization at its heart. To that extent, the impetus for DeFi is to remove centralized middlemen, such as banks, brokers, or exchanges and in doing so DeFi is using blockchain technology to facilitate peer-to-peer (P2P) transfers, borrowing and lending, along with trading of digital assets.

To that extent, financial technologies have transformed the banking sector, and there is an escalating competition between banks and emerging fintech corporations due to the fact that fintech has reformed banking operations and services. In line with this, innovations offer a platform for banks to distribute their existing services faster and more competently because by using AI, banks offer chatbots and virtual assistants, establishing a direct connection with clients and thus allowing the delivery of multiple services such as investing in cryptocurrencies or online banking without the requirement for human intervention. Likewise, fintech technologies allow non-bank corporations to deliver financial services conventionally offered only by banks, and so, new competitors will substitute traditional banks altogether.[24] It is characteristic that fintech's effect is in payments, clearing, and settlement services, and so, fintech assumes some of the functions that have conventionally been filled by financial institutions.[25]

Moreover, DeFi generates and functions as decentralized financial service offerings and applications on open-source software platforms[26] and so, DeFi protocols wrap a wide selection of financial services, ranging from lending and asset management activities to decentralized exchange functionality, and processing derivatives and other financial transactions. In fact, platform lending has changed the way people engage in lending and borrowing around the globe. Additionally, online platform lending enhances the efficiency of financial intermediation, which is not always conceived of as one of the central functions of banks. Chris Clarke[27] argues that

> ”While platforms are likely to be involved in a degree of integration with the “installed base” of existing capitalist sociotechnical devices and social relations, there is also always the possibility of reimagining their design outside the narrow financialised outlook promoted by financial inclusion initiatives.”

Also, DeFi works as a decentralized financial system, entirely without intermediaries such as financial institutions. On the one hand, in centralized finance (CeFi), trust is generated by the reputation and guarantees of intermediaries. On the other hand, in DeFi, trust is produced by the technical properties of the underlying blockchain technology, such as cryptographic techniques and consensus algorithms generating transparency and immutability, not mentioning that DeFi’s absence of intermediaries enhances working effectiveness and enables wider access to financial services. Furthermore, DeFi initiates a stable financial system that does not rely on centralized financial institutions or large banks.

DeFi embraces distributed ledger systems and smart contracts, presenting an alternative to the existing financial system. Hence, blockchain technology, in conjunction with smart contracts, offers the technical basis for DeFi applications. In the traditional CeFi setting, the lender stereotypically assesses the level of risk of the borrower, involving extensive know your customer (KYC) and anti-money laundering (AML) verification as the basis for defining the terms and conditions of the loan agreement. In the DeFi space, the lender cannot appraise the level of risk since the borrower is naturally anonymous; thus, the lack of risk evaluation is characteristically made up for by overcollateralization, which means that this overcollateralization protects against the high volatility of crypto assets.

The blockchain technology underlying the DeFi protocols guarantees true immutability using cryptographic methods and consensus algorithms; thus, immutability merges transparency and trustlessness because manipulations are transparent to all, and the network rejects illegitimate changes. DeFi gives everyone permissionless access to financial products and services at any time. From an economic perspective, the central risks and disadvantages of DeFi related to CeFi correlate with oracle dependency, the design of stablecoins, high levels of leverage, regulatory uncertainty, and possibly high barriers to entry for less well-off users participating in lower-value transactions. Moreover, the risks associated with oracle dependencies arise from the fact that many DeFi protocols are grounded in information which is offered by third-party providers. Consequently, DeFi protocols have to

rely on the reliability, accuracy, and correctness of this information, causing a security threat through malicious oracles that have an incentive to deliver incorrect information.

It is worth mentioning here that Bitcoin is seen as a speculative investment instead of an alternative currency or a medium of exchange even though several MNEs accept Bitcoin payments. It is characteristic that the problem with cryptocurrencies problem lies in their high volatility as a result of the inability to place a correct valuation, and so, if products and services are priced in Bitcoin, corporations will have high price-changing costs owing to the high volatility of Bitcoin.[28] To that extent, due to the high volatility of cryptocurrencies, stablecoins have been presented to the market and are anticipated to have stable value as they are pegged to another asset.[29] On the other hand, it is argued that the spillover effects of Bitcoin bring volatility on stablecoins.[30] In line with this, B. Thanh[31] et al. argue that

> "the price movement of large-cap stablecoins can be interpreted as signals on trading opportunities for smaller-cap stablecoins by investors. Therefore, large-cap stablecoins tend to drive smaller ones. The findings are expected to show how larger stablecoin price changes influence the prices of lower market cap stable coins because stablecoins users can easily switch between different types of stablecoins in the cryptocurrency market".

As mentioned earlier, DeFi creates a new form of financial intermediation, broadens financial inclusion, and augments operational efficiency stemming from the qualities of transparency, immutability, and trustlessness linked with the underlying blockchain technology, and from the character of the DeFi ecosystem to accelerate composability among highly interoperable protocols executing financial roles and services, such as lending, borrowing, and exchanges. Nonetheless, DeFi risks involve scalability issues of the underlying blockchain technology, privacy concerns owing to the transparency property of blockchains, and legal and regulatory reservations, such as the lack of KYC/AML checks.[32]

2.4 Financial Globalization

It is characteristic that globalization refers to the increasing integration of national and international financial markets, as well as the increasing international presence of major banks and other financial intermediaries, and consolidation refers to the growing size and cross-sectoral scope of financial institutions. Consolidation and concentration in the financial services industry have been raised particularly in the origination of syndicated loans and in derivatives markets. It could be argued that interactions between the effects of consolidation and the problems arising from marketization and globalization give further grounds for more extensive use of public safety net instruments. Recently, the global financial system has changed deeply, and technological improvements and deregulation have increased competition in the financial services industry. Hence, globalization has implications for the generalized injection of liquidity in the face of financial difficulties, inducing

national monetary authorities to react to international as opposed to solely domestic objectives.

Financial globalization offers measures and inducements for corporate insiders to better protect the rights of their minority investors.[33] Supplementary, investment in corporate governance is less beneficial in states in which the agency problem of state ruler option is noteworthy for the reason that many actions that establish corporate insiders decrease the risk of expropriation by the state.

It has to be taken into account that corporate insiders' trading conduct and investment horizon differ because of differences in investment patterns, liquidity desires, information access, and fears concerning restrictions on insider trading. Moreover, insiders are subject to some trading incentives that are not applicable to other groups of investors, such as delegated asset managers. It is characteristic that the trading conduct of insiders is affected by the horizon of their compensation contracts and so, many insiders build up shareholdings through their compensation package. Also, insiders have reasons to use their privileged access to private information to exploit trading profits by timing their purchases and sales. To that extent, Ferhat Akbas[34] et al. argue

> that "an insider's investment horizon establishes a benchmark for expected patterns of continued trading behavior and thus helps identify unexpected insider trades, which should be more informative in efficient markets…the trades of short-horizon insiders are both more unexpected and more informed, on average, than those of long-horizon insiders".

The significance of efficient financial markets lies in allowing those who want to obtain capital from different sources at reasonable rates. Financial intermediaries activate scarce savings, evaluate research projects, manage risk by evaluating future cash flow, and facility transactions. Moreover, financial constraints arising from imperfections in financial markets are a result of both information asymmetry and the politico-institutional environment.[35]

Enterprises globalizing their operations and the associated capital flows have become key players in the world economy, and cross-border conduct and capital flows span institutional settings with shifting investor protections and levels of capital market expansion. Does the rapid globalization of financial markets take humanity into uncharted territory? Global finance advances via new digital financial instruments. Is massive international lending a new phenomenon? The gold standard allowed huge flows of capital to search the world for the highest return, permitting rapid growth and fostering international trade, making gold standard look like the golden age of the international monetary system.[36] Capital mobility is today very high for short-term instruments but not for long-term capital movements.

It has to be taken into account that international capital mobility has prevailed in periods of political support either for subordinating monetary policy to exchange rate stability (as in the gold standard) or for giving up exchange rate stability so as to enable monetary policy to pursue domestic objectives (as in the post-Bretton

Woods era). Besides, when countries attempted at the same time to target their exchange rates and use monetary policy in pursuit of domestic objectives, they had to impose controls to curtail capital movements. International currency, flexible exchange rates, and sound institutions are considered benchmarks that defines conditions under which countries can integrate effectively into the world financial markets. In contrast, weak currency, fear of floating, and weak institutions are experiences of developing countries as they integrate into international financial markets. Financial market interlinkages create extensive interdependencies in the course of which a shock in one part of the system can be transmitted to others, exacerbating the contagion of problems from one economic unit to another.[37]

The globalization of international trade, in which markets are opened to flows of foreign goods and services, is necessary. To that extent, financial globalization has several crucial benefits in emerging market economies by bringing in new capital, lowering the cost of capital, and promoting investment, which in turn encourages growth. Hence, when foreign capital and financial institutions enter a state, they enhance the allocation of capital. Moreover, financial globalization needs to be widespread enough so that the entry of foreign capital and foreign institutions boosts competition in home financial markets. In fact, AI financial globalization is not only a choice but also a need to be the focus of the next great AI globalization.[38] Credit money is the form of money mostly circulated under conditions of financial globalization, and thus, due to instability of credit money, general instability has emerged in financial markets globally. Can uncertainty be regulated? The answer is no; however, ex ante rules will alleviate the consequences because uncertainty, being the motivating factor not only in generating profits but also in the character of financial markets, cannot be removed by regulation from financial markets. To that extent, Chris Clarke[39] argues that "uncertainty in finance might be beyond regulation but at the same time there is still a societal need to attempt to achieve a politics of uncertainty that can cope with ignorance of the future through experimental governmental efforts." On the other hand, AAI technology run by AAI humanoids and operating objectively within financial ecosystems will bring fair growth by correctly utilizing global resources.

Finance is subject to problems like incomplete markets, asymmetric information, and bubbles, requiring a necessity to prevent financial instability by controlling financial flows which means that the introduction of regulations within national boundaries, taking the form of preventing financial flows that are mainly geared toward speculative activity, is necessary. In other words, regulations must bring financial stability and promote governments' economic and social objectives. The productive sectors must neither be constrained by the price of finance nor by inadequate financial flows.

Financial globalization will develop a global institution that can play the central coordinating role.[40] Zekos considers that, in the AI era, IMF should take on new responsibilities and contribute to the harmonious financial development in a digital and global world. It is argued that a single currency will allow the global financial market to develop uniform credit standard requirements and, in the absence of the latter, this process will cause periodic financial crises and further intensify the

unequal distribution of income and wealth, which immediately contravenes the true meaning of the word globalization.[41] Also, financial development advances the effectiveness of capital allocation and lessens information and transaction costs, which means higher rates of technological growth, capital formation, and GDP growth.

To that extent, Zekos considers that the interplay of values among strong currencies is a dynamic factor for the movement of capital, creating development opportunities worldwide. Greenspan[42] suggests that

> "A clear benefit of financial globalization is that, to the extent that it reduces home bias, savings will be better directed to the most promising investments in the world, increasing global economic growth and prosperity. However, so long as risk aversion exists and trust is enhanced by local familiarity, we cannot expect that home bias will fully dissipate".

Moreover, Zekos believes that financial globalization allows for a better environment where capital will be moved around the world with fewer barriers, where productivity will bring higher profits. Thus, financial globalization means growth for developing economies as global savings are resourcefully directed to capital accumulation in developing countries where the marginal product of capital is highest. Integration requires individual countries to have the capability to attract financial capital, which is independent of external barriers and is determined by the internal state of the economies of the countries concerned and the future opportunities these economies can offer.[43] Developed and newly formed countries undertake various measures to prevent financial instability by controlling financial flows that are purely speculative in nature, ensuring that possible expansion in aggregate expenditure in the productive aspect of the economy is not constrained by inadequacies in the financial flow.

It is characteristic that financial globalization has diverse consequences for bank risk-taking, market power, efficiency, trade, economic growth, and business models. In fact, banks generate liquidity by transferring liquidity liabilities to illiquid assets or by offering off-balance sheet activities such as loan commitments or standby letters of credit. In other words, bank liquidity making assesses total bank output and shows a strong positive correlation between bank liquidity and real economic output, which means that liquidity making plays an imperative part in the economy.[44] Also, currently, AI financial globalization boosts liquidity construction by bringing additional lending resources to the banking systems of host countries. Subsequently, financial globalization and bank liquidity have implications for policymakers when articulating appropriate measures to deepen financial globalization.

Has AI financial globalization yield equitable benefits for all nations? In fact, foreign investors encounter informational barriers because of the gap between home and host countries and so, becoming cautious in taking risks, which means a reduction in liquidity creation. In line with this, S. M. Aamir Ali and A. Ghose[45] argue that

> "Although the concept of globalisation was initially intended to enhance the agency of developing nations, it has instead resulted in the erosion of their autonomy to independently determine their course of action. The democratic process has been impacted by the loss of decision-making power experienced by emerging countries as a consequence of globalisation. The rules governing globalisation were inequitably formulated to provide preferential treatment to developed nations. Contrary to prevailing popular opinion, the impact of globalisation on both developing and affluent nations has exhibited disparities".

The widespread deployment of robots and AI-enabled systems in many fields of economies globally has generated a digitized financial capitalism encompassing a shrinking workforce. In fact, digital capitalism is a transformation of the capitalist system of production in which digital technologies comprise the central production and control device in the global market which means that capitalism becomes digital when the production procedure of particular commodities is accomplished by and through privately owned digital technologies. Thus, digital capitalism encompasses the processes through which digital technology facilitates the structural tendencies of capitalism.[46] In fact, digital capitalism by encompassing digital networks is becoming vital part of capital assets worldwide by embracing metadata collected through cyberspace platforms, generating the formation of new market types in the exchange of goods, services, and money. Also, digital capitalism necessitates new work categories due to the fact that digital technologies serve as labor devices and infrastructure and so having a key role in certain production methods, as digital media are today both productive technologies and methods, which means that digital capitalism generates new managerial approaches because digital technologies are utilized as managerial means within corporations. It has to be taken into account that the relationship between digital capitalism and the digital/AI economy is that digital platforms have a key role in permitting people to become independent contractors working as freelancers, while employers choose the individuals that best fit their requirements.[47]

2.5 The Market, Banks, and Cash Management

It has to be taken into account that the market has risky assets, traded by informed investors, noise traders, and competitive market makers. Moreover, information transmits from the less informed investor to the more informed investor. Also, market competence advances or market liquidity degenerates according to the characteristics of the less informed investors' information, and so, total trading volume can be higher or lower.[48] To that extent, Itay Goldstein et al.[49] argue that

> "the well-informed investor never shares in-formation because doing so only dissipates his informational advantage and erodes his profit accordingly…an investor with coarse information optimally chooses to share information with a well-informed investor, because the former benefits from the latter trading

> against the shared information, which therefore dampens the former's price impact. By contrast, the well-informed investor never shares in-formation because doing so only dissipates his informational advantage and erodes his profit accordingly".

It is representative that interactions among investors are influencing trading strategies and financial market outcomes. Taking into account that sharing information is costly to investors due to the fact that it diminishes their informational gain, it is vital to understand the assistance investors get from sharing information.[50]

Banks wield deposit market power by investing in capital and, by holding reserves, circumvent costly liquidity deficiencies but do not entirely internalize the benefits. Anyway, banks put their positions/titles to hedge funds as a result of the higher balance sheet costs inflicted on banks by regulatory alterations, such as the launch of the leverage ratio after the global financial crisis. It has to be taken into consideration that the central bank's selection of deposit subsidies and interest on reserves influences the cost structure of banks, their price setting, and so the liquidity premium on deposits. More bank market power necessitates a higher deposit subsidy to inspire banks to lengthen their balance sheets. To that extent, Dirk Niepelt[51] argues that

> "unlike in the single-tier system, optimal policy in the two-tier system with its distortions requires fiscal resources or regulation to correct them. Dead weight losses of taxation or regulation therefore add to the social costs of the two-tier, but not the single-tier, payment system".

It is well known that banks are fragile, encompassing the likelihood of individual banks suffering a run, as a result of the provision of liquidity transformation and ultimately interlocked through fire-sale spillovers. Moreover, when facing withdrawals, banks liquidate their assets in a common market, which means that they compel negative fire-sale externalities on one another. Nonetheless, reducing bank fragility is welfare-improving for the reason that runs are linked to real resource losses owing to fire sales, and so, stabilizing the financial sector is an objective for the regulator which means that regulators have to maintain strong banks because the fragility of strong banks affects weak banks on the margin but not vice versa.[52]

The banking industry is undergoing a digital revolution[53] and so FinTech corporations and BigTech platforms are involved in conventional banking businesses using their innovative information and automation technologies. Also, "open banking" empowers borrowers to disclose their customer data stored in a bank with a fintech that has AI information processing technology but less access to customer data. Moreover, open banking enhances the fintech's screening competence, but, on the other hand, it diminishes lending competition and harms borrowers if the fintech corporation is "over-empowered" by the data sharing means.[54] Also, banks with higher IT adoption have larger loan growth due to the fact that an enhancement of a lender's IT augments its lending volume.[55] Cyberspace and AI employment exaggerate bank competition, resulting in lower banks' loan prices.[56] Also, companies' lending by banks with higher IT adoption is less influenced by the

distance between the bank headquarters and their borrowers. To that extent, Xavier Vives and Zhiqiang Ye[57] argue that "whether the development of information technology intensifies lender competition depends on its impact on differentiation."

Reliability of the market is decisive for financial stability. Capital regulation is a path through which accounting rules influence bank behavior and financial stability. It is worth mentioning here that some lenders might be part of criminal organizations that use IML to launder money and conceal profits from other criminal activities due to the fact that borrowers, discarded by any legal creditor, invest IML loans encompassing gambling, drugs, and alcohol. Moreover, the existence of IML is boosted by the extensive global adoption of interest rate caps limiting access to legal credit for risky borrowers, which means forwarding claims for illegal lending, and so, illegal money lending is dominant across the globe.[58] To that extent, K. Leong[59] et al. argue that

> "the crackdown was highly successful at lowering the payoffs of lenders and borrowers in the market, as well as lowering the total volume of loans disbursed. Removing borrowers from the market, either through offering formal market alternatives, rehabilitation or education programs, also hurts lenders, particularly if they focus on medium-performing borrowers in terms of loan repayment time".

It is worth noting that high leverage coupled with short-term funding when exploited to finance risky assets is very instable exposing banks to runs, which means that banks' disclosures concerning exposures to risky assets and funding structures play an imperative part in banks' stability. On the one hand, more wide-ranging disclosures offer relevant information regarding exposures to problematic assets and so diminishing uncertainty. On the other hand, more disclosures generate bank runs, initiating a panic among investors. To that extent, Jannis Bischof[60] et al. argue that "banks' disclosures about relevant risk exposures as well as the accounting recognition of loan losses came late, relative to the evolution of the crisis and concurrent market expectations. Many banks apparently were reluctant to communicate and recognize their losses."

Taking into account that a financial system encompasses interrelated fragilities, several elements influence financial stability by altering bank heterogeneity. Hence, regulatory policies limiting the dispersion in bank asset performances generate a damaging course for stability because when strong banks are forced to liquidate their assets, the asset market is harmed as a result of massive liquidations by weak banks.[61] To that extent, I. Goldstein[62] et al. argue that "a certain difference between banks' resistance to a common set of stress scenarios is desirable…Regulators should take a holistic approach and combine different regulatory tools to maintain a certain level of heterogeneity in the financial system."

It is characteristic that banks create value by lending and cash management, thus generating broad and persistent economic value. Moreover, cash management services amplify the value of a corporation's reputational capital. It is well known that cash management services move the supply and demand for products in wholesale

and retail markets. On the other hand, functioning without cash management augments both counterparty risk and administrative costs by forcing suppliers to transport, verify, and store cash which, otherwise, financial institutes direct. It has to be taken into account that problems regarding cash management services generate a "clientele effect," permitting them to sell at a price premium, which means that retail customers assign a lower marginal value to products sold at "dispensaries" without cash management.[63] In line with this, E. A. Berger and N. Seegert[64] argue that "businesses with cash management charge higher retail prices (8.3%), pay lower wholesale prices (7.3%), and have higher sales volume (19%). Together, these advantages create a 40% increase in profitability."

Furthermore, cash management services, such as safe storage, verification, and guarantee of funds, delivered by financial institutions yield substantial economic value for corporations and in case that corporations lack these services, they have to get alternatives offering internal warehousing of cash, which incurs costs to transactions and so switching resources from core trade. On the other hand, without warehousing, corporations utilizing digital banking, cryptocurrencies, and fintech solutions bear the costs of developing infrastructure to perform these functions. In line with this, E. A. Berger and N. Seegert[65] argue that "the benefits of warehousing exist regardless of whether national banks, credit unions, or fintech provide these warehousing functions."

It is characteristic that considerable value to investors arises not only from financial planning concerning portfolio construction but also from cash flow planning and benefits offered by plan optimization, bringing forth rewards from upgraded financial well-being. Corporations make investment, cash savings, cash payments, equity financing, and payout decisions to maximize their value. In addition, corporations hold more net financial assets for the reason that equity has become cheaper relative to debt. Taking into account that only tangible capital is pledgeable and the increase in intangible capital usage, corporations hold more cash.[66] Negative cash flows generate a stronger cash flow volatility impact on cash restrictions, causing the noticeable drop of corporation's value. It is worth noting that cash flow timing patterns offer valuable insights into corporate fundamentals and corporations' exposure to aggregate risks, embracing effects for asset prices[67] and real quantities. Nonetheless, financially constrained corporations exhibit a more noteworthy cash flow timing pattern. Hence, financially constrained corporations with higher year-end cash collections gain a higher risk premium. There is a link between realized macroeconomic variables and asset prices.[68] In line with this, W. He[69] et al. argue that "Macroeconomic perceptions generate the cross-sectional financing, investment, and valuation differences, thus driving the *time variation* in these equity market anomalies."

Financially constrained corporations have high financing requirements, and so financially constrained corporations with high equity financing demands collect cash payments[70] by year end to circumvent the high agency cost of year-end unpaid revenue. In line with this, W. Hu[71] et al. argue that "year-end cash collection leads to more risk exposure and higher stock returns." It has to be taken into consideration that riskier corporations, encompassing a higher link between cash flow and

the aggregate shock, have higher financing demands, which means higher optimal savings. While high cash collection diminishes profitability, higher cash collection indicates greater information transparency and thus reduces the cost of accessing the financial market.[72] To that extent, W. Hu[73] et al. argue that

> "Immediate cash payments negatively affect profitability, but reduce equity financing costs by increasing information transparency. Financially constrained firms optimally collect more cash at year-end when firms' performance attracts more attention and information transparency is more valuable. Such behavior further results in greater exposure to aggregate productivity and financial shocks".

First of all, subjective prospects influence corporate behaviors such as investments and external financing, while the evidence of biased corporate returns and growth prospects shapes corporate-level investment and external financing. Moreover, positive expectations of aggregate productivity inspire optimism among both corporate managers and investors, causing an increase in external financing and investment, a fall in financing costs, an upsurge in contemporary equity prices, and thus cutting a subsequent return. It is characteristic that activities of financially constrained corporations are more influenced by misvaluation shocks or behavioral biases such as overoptimism. Consequently, with an upward revision in prospects of aggregate productivity, financially constrained corporations issue a lot of actually low-quality debt. In the interim, managers could deliver overpriced equity and debt to utilize investor optimism, which means subsequent return reversals for financially constrained corporations. To that extent, W. He[74] et al. argue that

> "following upward revisions in expectations of macroeconomic conditions, subsequent equity returns are relatively low for small, risky, unprofitable, low-quality, and financially distressed firms. On the other hand, following downward revisions in expectations of macroeconomic conditions, these categories of firms earn relatively high subsequent returns. Thus, revisions in expectations of macroeconomic conditions induce strong predictable time variations in anomalies based on these characteristics. In particular, favorable revisions in expectations of aggregate productivity predict stronger profitability, quality, and low-risk anomalies but weaker value, investment, and size anomalies".

In fact, financial constraints augment the mispricing instigated by credit sentiment or extrapolation.[75] Also, macroeconomic movements and monetary policy actions have a greater influence on the contemporary fundamentals and returns of financially constrained corporations. Moreover, the investment and debt issuance of corporations with lower credit scores are vulnerable to credit conditions.

It seems that bank borrowers count on credit lines to manage cash flow shocks, and lenders charge borrowers for liquidity provision. Moreover, corporations functioning with old capital are riskier for the reason that costly technology adoption hampers their flexibility in progressing to the latest technology, making them more

subject to technology frontier shocks. Also, corporations embrace the latest capital or keep running with the existing mode, which is turning out to be outdated and less valuable over time, meaning that by undertaking the latest technology, a more competent capital is instated.[76] It has to be taken into account that gross investment is larger when the corporation's capital is inadequate, given that current capital cannot be utilized for the operation of the new technology. Furthermore, expensive new technology implementation hampers corporations' flexibility in updating their capital stock concerning technology, furthering the risk dispersion between technology-adopting corporations and non-adopting ones.

Corporations use cash management to foster reputational capital, permitting them to demand better terms in the wholesale market and advancing quality guarantees to consumers in the retail market. The Total Cash Management System lets MNE to produce positive cash flow, ensuring its operational use to cause future cash flows which means that the application of Total Cash Management supplies a platform for both present and long-term objectives in the international financial management of MNEs, and so a MNE has a prospective to get financial resources owing to the geography of its undertakings. Hence, MNEs have easy access to the devices of both local and global financial markets, and so MNEs have to choose the most effective financial resources and their sustainable management. To that extent, crypto assets provide a new way of financing MNEs.

MNEs have a high credit rating, allowing them to access cheaper resources and the availability of liquid assets and intensive cash flow let MNEs to diminish the cost of obtained capital, real sales evolution, and an upsurge of investment attractiveness, which means offering financial stability and opportunities for obtaining capital. Moreover, MNEs are amalgamated into the global financial system, and their finances are its structural elements, allowing leading global banks to offer conditions for the transparency of their activities and thus escalating the opportunities to obtain debt funds from credit organizations. Corporations and MNEs try to raise financing when banks cut lending.[77] On the other hand, there are shortcomings for MNEs due to currency, transaction, political, and economic risks affecting the decision regarding the selection of financial resources.[78]

2.6 Venture Capital and AI

VCs have a decisive role in the economy as a result of their uneven contribution to corporate R&D and innovation. Moreover, VCs offer liquidity to founders, tempting them to become entrepreneurs.[79] In line with this, Michael Ewens[80] et al. argue that

> "while a post-product increase in cash compensation makes founding a startup more attractive than a contract that pays a flat salary, low pre-product compensation can still leave high earning potential founders holding substantial non-diversifiable risk…variation in the expected time to product development is a key driver of the relative attractiveness of entrepreneurship across sectors for potential founders with attractive options outside of

> entrepreneurship and in sufficient personal wealth to finance consumption while waiting for a product to materialize".

It is worth mentioning here that AI utilization across businesses is on the uptick; however, there is some concern regarding the use of AI, involving algorithmic aversion and fear of machine bias.[81] Taking into account that an algorithm is as good as the data it works with, AI can identify and correct human bias, and multiple devices exist that identify and adjust for such.[82]

VC evolved to fund promising startups that otherwise lacked the established presence required to safeguard business loans in exchange for an equity position. Regardless of the advances in AI and VC's focus on tech startups, VC corporations themselves have failed to employ data analytics and machine learning in their own decision-making, relying instead on copying the investments of other corporations. The use of AI by VC corporations advances investment outcomes.[83] Moreover, VC has shifted away from that of an advisor offering governance and oversight to startups, to that of a speculative hands-off financier. Even though originally VCs played active management roles in delivering both oversight and corporate governance, such is no longer the case, and so VC corporations are less involved in developing and growing emergent businesses, capitulating to the impulses of their founders whose business strategies are grounded in undermining the competition to dominate the market.[84] To that extent, VC corporations merely copy the investments made by other corporations. Also, while the absence of due diligence results in unsuccessful investment decisions, the use of AI in investment decision-making offers better investment results.

Furthermore, AI can alter the entire VC landscape by opening the door for a greater number of successful startup openings, while concurrently expanding corporation investments which means that by integrating AI into the decision-making process, corporations can mitigate the influence of human bias and deliver more accurate decisions than those delivered by human experts. Thus, corporations that exploit objective, data-driven approaches to investment platforms will outperform those that do not, and so incorporating data analytics into VC investment decision-making will augment profit opportunities and expand portfolio diversification.

It is worth mentioning here that specialization leads to lower risk in cross-border investments from a venture capitalist's point of view, which means that with escalating deal-specificity, the support and value improvement of a foreign portfolio corporation are guaranteed in international markets as a result of the investor's specialization. Moreover, as venture capital corporations invest in new businesses functioning in ambitious markets, these investments are typified by high levels of asymmetric information and uncertainty. In line, investors encounter institutional, geographical, cultural, and legal distance from their own countries, which means that this inaccessibility rises higher information asymmetries, investment risk, and costs for the investor if the target business is located abroad, and so the investor allocates more resources to supervising and managing the business abroad.[85] Concerning venture capital, A. Nörthemann[86] argues that

> "the likelihood of a cross-border deal increases with higher levels of industry specialization. Furthermore, this effect is moderated by determinants at the institutional and portfolio company levels, reflecting the degree of information asymmetry between the venture capital firm and the portfolio company."

A crucial factor in the appeal of venture capital (VC)-financed entrepreneurship for high-earning prospective founders is the anticipated time to create a startup's initial product for the reason that founder-CEOs' cash compensation rises significantly after product development, thus lessening the non-diversifiable risk that founders encounter at startup birth. Consequently, a startup's projected time to develop its first product is a crucial basis for the appeal of VC-sponsored entrepreneurship. To that extent, Michael Ewens[87] et al. argue that

> "the increases in CEOs' cash compensation after a startup begins product development are large enough that non-diversifiable risk held by founder-CEOs falls substantially after achieving this milestone…a startup's expected time to developing its first product is a key determinant of the attractiveness of VC-backed entrepreneurship".

Hence, increases in CEOs' cash compensation after a startup begins product development are large enough that non-diversifiable risk held by founder-CEOs falls substantially after achieving the product development breakthrough.

On the one hand, Felix von Meyerinck[88] et al. argue that

> "directors' involvement in forced CEO turnovers can be expected to be assessed by the market and to affect directors' reputation…Directors interlocked to a forced turnover experience an economically large…directors are not penalized for involvement in a CEO turnover *per se* but for forced CEO turnovers that are related to governance failures by the board".

On the other hand, sacking a CEO is seen as an indication of malfunction in the supervising and is harmful to a director's status.

It has to be taken into consideration that conditional risk not only clarifies profitability and investment, but also supervising conditional risk is imperative for judging the economic significance of variances, appreciating market competence, and assessing the performance of asset managers. N.J. Gormsen and C.S. Jensen[89] argue that **"**Overall, the impact of conditional market risk on anomaly alphas is larger than the impact of unconditional market risk, suggesting that researchers and practitioners should seriously consider controlling for conditional risk whenever implementing the CAPM in the future."

It is characteristic that venture capitalists with high social status in the national market invest abroad due to augmented national experience. Moreover, the positive development of a portfolio corporation is expected when the investor is accustomed to business patterns in the particular industry of investment. Additionally, industry-specific knowledge is vital in ascertaining good investment opportunities and adding value to corporations.

Also, corporation-level factors such as industry specialization or ties to a foreign country[90] play a part in investment decisions. Antonia Nörthemann[91] argues that

> "the probability of investing abroad increases with higher degrees of industry specialization even though international deals are often associated with higher risk. This relationship illustrates how the liability of foreignness has a varying influence on an investor's investment decision depending on the investor's specialization in the specific industry to which the deal is assigned."

It is worth mentioning here that venture capitalists do not seek long-term progressive growth of the business where they invested, since this would not let an acceptable return on all the capital invested, which means that they demand well-timed and substantive results.[92] It is worth noting here that the active portfolio optimization allows investors to gain access to stocks, bonds, and private equity (PE) funds, and so ex ante commitment has large consequences for investors' portfolios and welfare.[93] To that extent, Elise Gourier[94] et al. argue that

> "investors want to change their capital allocations when capital is called—most often to increase the allocation. Hence, investors are under allocated to PE and willing to pay a large premium to adjust the quantity committed upon capital call. A direct implication of PE under allocation is that the demand for changing the amount committed is asymmetric. Investors would rarely want to reduce their allocation to PE, but highly value the option to top-up their allocation when capital is called".

Furthermore, venture capital and private equity have achieved importance in the market, and so venture funding for R&D has stimulated the establishment of several startups. To that extent, Shaun Wang[95] indicates that an augmented level of R&D input improves the corporation's value growth.

Financial liberalization is one of the most important aspects of globalization involving both short-term capital flows and FDI. Moreover, financial globalization is illustrated by the fact that trading in the global foreign exchange market has far outpaced the growth in international trade in goods and services. Additionally, foreign exchange is increasingly being treated as an asset or a commodity, not just as a means of payment, with a parallel increase in the use of derivatives in foreign exchange markets. Changes in global conditions, such as the decline in nominal interest rates, gave a spur to capital flows to emerging markets. Moreover, international trade is changing because of the introduction of new technologies, innovations, and geopolitical modifications, which means they are opening up new prospects for international business and trade expansion.[96] Taking into account that performance-targeting incentives upset corporate policies, competitive forces stabilize the strain to meet performance targets via alterations in other corporate policies, such as investments in capital and innovation.[97]

2.7 AI and Financial Markets

Markets are powerful institutions run by law encompassing public and private regimes fashioning entitlements, enforcing market exchanges, and restricting expropriation, which means that distinctive types of markets exemplify fluctuating normative concepts of the market. To that extent, Hanoch Dagan[98] et al. argue that "appreciating the significance of law as the infrastructure of markets reveals that no particular market structure is inevitable. Instead, every market order is the result of a complex set of legal and political choices." On the one hand, markets are the invention of human societies, and the form of any market is grounded in the legal rules guiding actors' behavior in the market. On the other hand, beyond the law, markets function according to economic principles articulating their running. In other words, while markets are in part legal constructs shaping their construction, competent markets are invented so as to maximize economic output. To that extent, an AAI technology will be able to illustrate the interplay between legal and economic principles in valuing the role of the market at any moment in order to make the right predictions.

The appearance of international digital trading settings has made it possible for corporations to globalize operations on different trading platforms. Long-term financial planning takes a considerable amount of time in every corporation. The financial market has emerged as a place where debt, cash, and financial assets are exchanged; thus, the financial market is a system encompassing a set of financial transactions that are traded and embraces all organizations that act as financial intermediaries, directly or indirectly. Moreover, financial markets are incorporating a procedure under which financial assets are traded professionally, cost-effectively transferring financial resources from surplus sectors to sectors with medium and long-term financial deficits, manifesting several benefits for borrowers and investors. Also, financial markets handle securities, other than the monetary market, and informatics allow dealing from outside the market through brokerage firms spread across different states owing to the globalization of financial activity and the merger of capital markets. Additionally, financial markets deal with the management of funds as a key function in economic growth, having an impact on individual wealth, companies, consumers, and on economic flows.

Has AI caused financial market disruption? It is characteristic that the running of the financial markets is interconnected with business activities since one of the roles of banks and financial institutions is to offer access to the capital required by corporations and individuals. Consequently, financial markets are under the influencing powers of digitalization and "globalization." Also, corporations are seeking financing outside the banking sector, while the transformation of the business environment in financial markets is ongoing. It is worth noting that the financial market disorder is associated with the aftereffects of digital disruption for businesses and individuals, resulting in the direct and indirect spread of digital disruption to finance as a role and industry. To that extent, the arrival of electronic platforms has empowered numerous new

activities such as the financing of corporations.[99] Which is the role of AI in financial markets? AI will offer the data and predictions about the development and functioning of financial markets, allowing an objective approach, spotting any instances of corruption, and preventing crimes such as insider trading and money laundering.

It has to be taken into account that financial markets activate financial resources, directing them toward investment with the purpose of motivating financial operations and advancing their prospective returns. Revolutions in capital market technology have transpired at the level of the technologies and financial instruments available in the financial market, which have globalized in a manner that boosts the flow of capital and the global capital market integration. Also, financial markets' effective and resourceful character is grounded in their capability to enlarge the size of the market by reinforcing their institutional and regulatory structure in order to exploit the benefits and drop the risks of financial liberalization, predominantly capital account liberalization and the integration of global financial markets.

As mentioned earlier, digitization is the process of transforming information from analogue to digital format, such as paper letters to email communications, or paper receipts to digital receipts, and so corporations keep better control of business activity and the capability of starting some basic automation. Moreover, startups emphasize the point that technology entails a solid business model or a disruptive transformation so as to engross all the prospective automation effectiveness and growth capabilities leading to digitalization, where corporations align and digitally transform their business model. Hence, digitalization is altering people's ways of searching for and buying products and services due to the fact that digital platforms[100] are fundamentally transforming the people's interaction. Also, digitalization offers businesses new modes to grow, reach prospective customers, and expand into new markets globally. The use of Chatbots, WhatsApp, Instagram, and other digital platforms has become common in B2B[101] relationships, and so there is a move in customer behavior, a transformation in technology, and an alteration in the market. Hence, corporations must keep up and learn about their customers' emerging habits. To this extent, the digital platforms have started a global rivalry, which means that if one firm fails to meet expectations, the customer finds other routes.

It is characteristic that corporations optimize their current business models in order to build up new products, services, and so achieving efficiency and flexibility. It has to be seen that optimizing short-term profitability does not automatically guarantee optimum shareholder returns in the long run. Consequently, data analytics, cognitive systems, AI, data-based business models, and platforms are used to stimulate growth.

It has to be taken into account that in order to be valuable, financial control systems have to mirror a corporation's strategies and objectives. Management control systems should encourage managers and other employees to use maximum effort through a sort of monetary and nonmonetary rewards.

2.8 Metaverse and Non-Fungible Tokens (NFTs)

It has to be taken into account that the integration of AI with VR and AR technologies is amplifying their collective effects within the metaverse by facilitating the formation of hyper-realistic simulations, the development of AI entities along with the enablement of deeper, more expressively involving interactions between users and AI entities.

Additionally, it has to be taken into consideration that digital entities are reforming the conception of identity, escalating it beyond physical individuals due to the fact that AI entities are simulating human behavior, presenting diverging levels of interaction, autonomy, and behavioral complexity within the metaverse, which means that AI humanoids can appear as virtual assistants, companions, or social media influencers[102] interacting with people and organizations and guiding human behavior.

It is characteristic that the emergence of the Metaverse and NFTs has initiated substantial alterations in ownership and participation in virtual economies online. The Metaverse is a shared online space that combines elements of the physical world, digital spaces, and cyberspace in generating a unified, interactive environment. The metaverse reshapes digital and physical lives. It could be said that virtual reality, augmented reality, blockchain, and AI are central technologies in creating engaging experiences and making sure new content is both safe and dynamic.

It is worth noting here that "Metaverse Identity"[103] incorporates personal characteristics and economic essentials in demonstrating a new frontier in inspiring self-expression by enclosing technological advancements, clarifying an energetic interplay between innovation and identity formation.[104] It has to be taken into account that the perception of digital identities and management within the metaverse allowing interoperability is the basis of an interconnected metaverse[105] system. Hence, the standardization of metaverse identities allows the advancement of the metaverse ecosystem. Thus, the absence of standardization and trust across platforms diminishes users' ability to keep social value across multiple platforms.

NFTs are unique digital assets. The rise of NFTs has provided creators, including artists, musicians, and digital designers who create the original content that becomes tokenized as NFTs, with new ways to monetize their work, permitting them to claim ownership and receive compensation in manners that were not formerly conceivable. NFTs, cryptocurrencies, and Web3 technologies are producing new paradigms for money, possessions, and markets.[106]

Due to the metaverse's qualities, there is a need for robust mechanisms to protect user data, guaranteeing safe interactions in digital environments. The underlying technology of NFTs is assembled on blockchain, a distributed ledger that documents transactions across a network of computers, safeguarding data integrity and security. NFTs' transformative prospective in digital ownership and asset management within and beyond the metaverse necessitates a move toward more intelligent, responsive virtual environments. The Spatial Web merges the physical world with virtual spaces, making the web more multidimensional.[107]

Furthermore, NFTs assign distinctive identifiers and metadata to digital assets and so making certain their indivisibility and distinctiveness, which means that NFTs brought a transferal in the monetization of digital content, empowering creators to energetically assert intellectual property rights. Hence, via the utilization of smart contracts, NFTs not only enable direct monetization but also allow the buildup of royalties from secondary market transactions and so advancing economic empowerment among creators within both digital and virtual economies. Thus, NFTs augment the liquidity and utility of virtual goods, playing an influential role in the proliferation of DeFi and accelerating the convergence of virtual and real-world economies.

The liquidity challenges arise due to an unplanned need for cash or securities and so capital regulations oblige banks to have liquidity buffers, which contain buffers for intraday liquidity. Managing liquidity is an existential activity for financial institutions, and iquidity management is muddled by "legacy" payment arrangements and financial market infrastructures.[108]

NFTs leveraged blockchain technology to offer a solution to the digital replication challenge, enabling the creation of unique, verifiable digital assets. The extension of NFTs to virtual real estate reflects a broader application of this technology, illustrating its capacity to facilitate ownership in entirely digital environments, notably within virtual worlds or the metaverse. Virtual real estate transactions via NFTs underline the economic prospects of virtual spaces, offering opportunities for investment, development, and commerce similar to physical real estate but within digital landscapes. Taking into account that AAI humanoids might be able to live in both conventional and digital landscape and so giving another dimension to the role of fiat and digital currencies due to the different demands of the two different dimensions of economic and material life of the inhabitants of both environments.

It has to be taken into account that digital platforms present the technical infrastructure needed for issuing NFTs, which means offering means that convert digital content into blockchain-based assets with verifiable ownership. Therefore, digital platforms offer the space to act between creators and the broader market, which means managing effectively digital assets. Interoperability and standards are central to the functionality and prevalent adoption of NFTs across several blockchain environments, and so allowing NFTs to be effortlessly traded, viewed, and used beyond the confines of their original platforms. Moreover, interoperability lets NFTs formed on one blockchain to interact with applications and users on another.

It is worth noting here that the decentralized quality of blockchain,[109] while advancing advantages in transparency and security, also confuses the control and protection of personal information. Hence, although blockchain technology offers a level of security through its immutable ledger, the interfaces and platforms users interact with denote features of vulnerability, which means that possible phishing attacks, smart contract exploits, and other forms of cyber threats present real risks to NFT owners. Furthermore, due to that fact that NFTs run on blockchain technology necessitating substantial computational power, the energy consumption linked with producing and trading NFTs has caused concerns regarding their sustainability.

It has to be taken into account that the development of virtual worlds[110] is producing a new virtual economy encompassing many different virtual assets of core value. At the same time, the composability of NFTs[111] with DeFi is generating new investment prospects in an open financial system. Also, the decentralized character of NFTs and the absence of a standardized technique to assess their valuations are generating exploitation opportunities for AML, and thus NFTs could be leveraged by illicit players in concealing the real value of financial transactions or other business activities. Therefore, unregulated NFTs can be utilized to implement financial crimes such as money laundering and for conducting other unlawful activities.[112] In banking, the use of AI in AML and fraud detection has altered financial crime inspections, leading to more targeted identification of financial crimes.

Taking into account that NFTs are unique goods conveying information about the source in commercial trade, Andrea Mccollum[113] argues that "NFT tokens could be considered mere 'ownership receipts' for creative works rather than digital goods that are sold using association with a brand." Moreover, NFTs are digital tokens that are stored using blockchain technology and contain metadata tying the token to a specific asset. Hence, NFTs offer the purchaser a digital link to a linked asset stored using blockchain technology. Thus, the transfer of assets using NFTs serves as a device for monetizing all types of digital content. In line, Andrea Mccollum[114] argues that "NFTs and other blockchain-based assets will likely impact many areas of daily life in the future. Brand owners should be afforded the same protection in these spaces that they enjoy for tangible goods produced in the real world."

It is characteristic that blockchain technologies and cryptocurrency will not be treated differently from other types of commercial products under trademark law, and sales of NFTs amount to engaging in commerce.[115] It is argued that trademarks linked with physical items offer protection for digital reproductions of those items, which means that the MetaBirkin NFTs "could constitute a form of artistic expression," and selling the images did not make them simple commodities rather than expressive works[116] and so, the court held that the "title 'MetaBirkins' should be understood to refer to both the NFT and the digital image with which it is associated."[117]

2.9 Security and Tokens

DLT and the blockchain empower the digitization of any asset class as tokens and are shaping the manner toward future of financial markets. Security token offerings (STOs) are advancing funding, where digital tokens are issued as regulated investment products on the blockchain. Once the token offering has taken place, the tokens are traded on the secondary market. Does the uncontrolled offering of digital money without any examination of its value generate over-offering of money leading to devaluation?

Security tokens[118] denote shares of ownership in corporate equity, fixed income, investment funds, commodities, or less liquid asset classes such as real estate or fine art, comprising a new form of venture financing having several advantages

because corporations easily reach a large investor base while dropping transaction costs.

First of all, transparency concerning the transactions is accomplished through the blockchain, and the interoperability of the blockchain solves the problem of lack of compatibility between different systems or databases, allowing self-custody of any tokenized asset on one platform.[119] Another major advantage of STOs is the prospective liquidity offered through the likelihood to transfer and trade tokens on secondary markets, which means that security tokens merge the advantages of the underlying technology with the legal protection of conventional securities.

Security token offerings are a method for corporations to increase capital where they issue digital tokens as regulated investment products on the blockchain. By transferring a digital token, the participants transfer the ownership or other property rights over the asset represented by the token without the intervention of traditional intermediaries. J. Kreppmeier and R. Laschinger[120] argue that

> "companies that intend to raise funding via STOs would be well advised to offer a pre-sale phase in their STO and assure their intentions to trade the tokens on the secondary market while already devising a plan for successful future trading. From an investor's perspective, these signals can be interpreted as positive quality signals on the basis of which appropriate investment decisions are conducted".

STOs allow investment in securities recorded on a blockchain. In line, Thomas Lambert et al.[121] argue that "entrepreneurs should carefully design their security tokens and run their offering professionally because doing so may not just help them raise more capital, but it may also foster general awareness of the benefits of a well-developed STO market."

2.10 Crypto Assets

A crypto asset is a digital asset that functions through the digitalized distributed ledger or the blockchain. Crypto assets have appeared as a key movement in digital transformation and, by utilizing new technologies, are distinguished as one method of advancing financial operations. Moreover, crypto assets are being integrated into financial services applications to make possible near real-time transactions, accurate data recording, and more efficient payment processes. Hence, crypto assets create efficiency advantages in the financial sector by transforming the performance of financial markets to enable the exchange of value without the necessity for a central authority or intermediary, which means that crypto assets generate openings for the financial sector.

It could be said that crypto-assets markets are fast advancing and reaching a point where they will epitomize a threat to global financial stability as a result of their scale, structural vulnerabilities, and augmenting interconnectedness with the conventional financial system. Also, the swift evolution and global quality of these markets create the prospect for regulatory gaps, fragmentation, or arbitrage.

The emergence of Bitcoin and other cryptocurrencies has generated an anonymous alternative financial system, which means that criminal networks now have new openings to circumvent detection and seizure of funds. Nonetheless, crypto is hardly ever used as a medium of exchange to purchase goods and services and so is normally converted from and back to fiat currencies, such as US dollars, which means that the entry and exit points into the crypto ecosystem are crypto exchanges adhering to international laws designed to mitigate illicit financial flows. Also, while cryptocurrencies are aimed to be anonymous, the environment in which the transactions clear on the blockchain presents a ledger that tracks the movement of funds; thus, blockchain transactions are quasi-anonymous which means that, via algorithms, it is clarified where funds enter, move through, are exchanged into different cryptocurrencies, and exit the crypto ecosystem.[122] Thus, cryptocurrencies are another cost-effective network for moving illicit funds across borders. To that extent, John M. Griffin and Kevin Mei[123] indicate that "the network of scammer nodes is highly connected, likely indicating that there exist widely-used services that funnel funds for extremely large and possibly related criminal networks." It seems that clustering AAI algorithms can be used to detect Bitcoin transactions for moving funds across sovereignties.

It has to be taken into account that while public equities trade on established secondary markets like the NYSE or NASDAQ, crypto assets trade on hundreds of upstart markets.[124] Moreover, crypto networks and tokens are devised by developers and then, by using blockchain technology and often smart contracts, conceived to run autonomously after setup. It also has to be taken into consideration that cryptocurrency investors rely on networks and media for evaluating new information regarding AI and AI tokens, leading to unusual price outcomes. ChatGPT is utilized in the crypto assets market for predictions, and so, AI tokens revealed higher returns linked to non-AI tokens around the launch of ChatGPT.[125] To that extent, Ante, L. and Demir, E.[126] specify that

> "crypto asset markets are highly fragmented. While there was virtually no relevant attention for AI tokens before the launch of ChatGPT…investors should closely follow the developments related to specific themed tokens as their dynamics can be different from the rest of the cryptocurrency market."

In line with this, Jang Ho Kim[127] argues that "asset class recommendations by ChatGPT improves portfolio efficiency compared to more diversified portfolios… Interestingly, the three indicators chosen in our analysis are market indicators that are also published with daily frequency (e.g., breakeven inflation rate measures daily expectations)."

In the EU, the Crypto-Assets Regulation (MiCA) aims to restrict the issuance of stablecoins to banks and so-called e-money institutions. Moreover, the Regulation of Digital Operational Resilience Act (DORA[128]) strengthening cybersecurity, and Regulation (EU) 2022/858, which regulates distributed ledger technology,[129] accelerate digital innovation in the interest of consumers and market efficiency. Only public authorities' ex ante review, coordinated by ESMA, affirms a harmonized

application of MiCA. Also, MiCA identifies its scope by referring generically to tokens that are not yet regulated by existing EU financial legislation. To that extent, D.A. Zetzsche et al.[130] argue that "all crypto-assets could be deemed, at first and prior to any involvement of supervisory authorities, 'transferable securities' unless (and until) they are exempted and requalified by NCAs applying the classification criteria promulgated by the (Joint) ESAs under MiCA."

It has to be taken into account that the "cryptoization" of finance refers to when crypto "assets are substituted for domestic currency and assets, and circumvent exchange and capital control restrictions," demanding global regulation due to its digital nature.[131] To that extent, Gordon Y. Liao[132] et al. argue "that payment stablecoins are proportionally less employed for trading and leveraged speculation activities than the fiat counterparts." Moreover, crypto tokens have been judicially regarded as a form of property.[133]

It is underlined that decentralized financial technologies could be used to circumvent regulation via anonymization, while raising fears concerning regulatory enforcement and increasing jurisdictional uncertainty because of these technologies' operations regardless of borders.[134] It is worth noting that decentralized financial services expand financial inclusion, enable open access, and generate new openings for financiers and innovators, and so, decentralized networks cut transaction costs and produce network effects without encountering monopoly costs. In other words, once a decentralized peer-to-peer network tries to dominate, it cannot accumulate enough monopoly power to monopolize the network and prohibit others from participating, letting everybody to gain from the network consequences and so broadening transaction opportunities.[135] Moreover, decentralized finance generates a trust-minimized and automated version of traditional financial infrastructure.

It has to be taken into consideration that data "propertization" empowers data corporations to enforce monopoly power across the market by increasing barriers for prospective market entrants.[136] Monopoly power causes discriminatory trades in data collection markets as a result of information asymmetries and bargaining power disparities. To that extent, Z. Chadambuka[137] argues that

> "Data ownership would raise what is already a high cost to democratic politics from data. Applied to data, private property would make a sharp switch from providing for political liberty through ensuring decentralization of power and head off down the path to supporting centralized political control in the data-powered internet age. It would also move the dial backwards, taking society out of contract and back to status…law should provide protection against dangers from not just data collection, but also data processing, trading, and use".

Digital platforms that run on blockchain technologies offering products and services use their own digital currency to settle transactions and rely on decentralized governance. It has to be taken into consideration that the FTX failure was a classic liquidity crisis that turned into a solvency crisis, like that of Lehmann Brothers in 2008, and so, the crashes of Babel Finance, Celsius Network, BlockFi, and Genesis

were more of crypto lending corporations. Moreover, each collapse demonstrates the same pattern of noteworthy interconnected centralized crypto intermediaries becoming unstable as a result of mismanagement, malfeasance, fraud, theft, and a general lack of transparency.[138] To that extent, Douglas W. Arner et al.[139] argue that

> "while crypto was presented to the world as a new type of finance avoiding the risks associated with traditional finance, in practice, agency, operational and financial risks have evolved across the ecosystem and crypto has proven not to be immune from traditional risks of finance".

Also, T. Yuyama et al.[140] specify that

> "although the stock market is correlated with the crypto market, the correlation is negatively affected by crypto-specific risks. Therefore, the contagion effects of a crypto meltdown on the traditional market are not yet apparent and limited. In fact, we find: extreme volatility in the stock market can cause extreme volatility in cryptos, but not the other way around. The finding is consistent with the case of FTX's collapse…stock-specific risks spill over to crypto-assets, and consequently increasing the linkage between both markets, while the crypto-specific risks have limited spillover effects at the current stage, and are contributing toward a lower linkage between both markets. Risk spillover is likely to be one-sided and limited from crypto-assets up to this point. However, this may be because traditional financial institutions have little crypto-asset exposure".

Thus, if transactions between the crypto-assets industry and the traditional financial sector increase in number and size in the future, the connectedness through crypto-assets holdings may lead to risk spillover. To that extent, the risk in the crypto ecosystem on financial stability depends critically on how interconnected it is with the traditional financial sector. Likewise, Azar, Pablo D, et al.[141] argue that

> "financial stability risks are not extensive because the digital asset ecosystem does not provide significant financial services and its interconnections with the traditional financial system are limited. At present, the potential spillovers from runs on stablecoins that are backed by money market instruments represent the most salient financial stability risk."

It is characteristic that crypto assets growth has been accompanied by major volatility, with most crypto coins going through several cycles of rapid growth followed by spectacular collapses. Hence, crypto asset markets act both as a source of shocks and as amplifiers of overall market volatility; thus, they have implications for financial stability because crypto assets incorporate technological attributes and features, serving as means of payment by decentralizing finance,[142] to store value, asset transfer, privacy, digital identity, and governance.[143] To that extent, Roshan Iyer and Adina Popescu[144] indicate that

> "the interconnections between crypto assets and financial assets are lower compared to within their respective asset classes, in terms of both sending and receiving returns and volatility spillovers. Furthermore, we show that crypto assets primarily transmit spillovers to financial markets, although during periods of financial sector stress, the reverse may also occur."

Some market participants see existing stablecoins as substitutes for fiat currency in the crypto-asset ecosystem, but they are not widely used outside crypto-asset markets.[145] Data gaps and challenges avert authorities from making more conclusive or empirical assessments of stablecoin activities. It is characteristic that crypto asset markets risk being subject to fraud by crypto asset sponsors.[146] Moreover, asset digitization through distributed ledger technology has transformed trading markets, and hundreds of crypto assets are traded on various crypto exchanges, which means that the group of tradable assets is growing.

Due to the fact that cryptocurrencies are highly volatile assets, it is critical for investors to form a comprehensive investment strategy by employing risk-management measures before entering this market so as to mitigate the prospective for market crashes. Thus, investors should embrace a comprehensive investment strategy by incorporating "trend following" rules and respecting the impact of transaction costs. In this context, Trinh Le and Ummul Ruthbah[147] argue that

> "both individual and institutional investors can benefit from applying a momentum (risk overlay) strategy to invest in crypto assets, as it allows them to capture the upside potential and avoid the downside risk of these volatile instruments…investors should carefully consider the trade-off between transaction costs and portfolio rebalancing when implementing trend-following strategies in crypto markets".

It could be argued that there is a need to estimate the value of crypto assets.

It has to be taken into account that crypto lending platforms contribute to the transformation by drawing crypto-asset deposits from retail customers with high interest rates and using those funds to make loans. Hence, lending platforms use customer assets to make undercollateralized loans, which means that when lending platforms use depositors' assets to raise leveraged positions, and so, they escalate the fragility of the crypto ecosystem. Thus, lending platforms provide collateralized crypto-asset loans to retail customers and uncollateralized or partially collateralized loans to crypto-native institutions.[148] It is characteristic that Ruchi Patel[149] indicates that

> "crypto-colonization has relied heavily on the neoliberal policies, populist discourse…The resulting coalition of the crypto state and crypto elite has facilitated novel forms of territorial, resource, and political control at local and national scales. Despite the novelty of the crypto political economy, it inevitably reproduces the uneven, extractive, and neocolonial dynamics of neoliberal development in that it feeds on Global South geographies to export value North. Bitcoin thus serves foreign capital investment, accumulation,

> and imaginaries rather than the needs and systemic challenges of the poor. What is most worrisome is that the new crypto order operates with little transparency, oversight, or accountability of potentially harmful practices—from the so-called aid programs of Bitcoin Beach to wider crypto development and land grabbing schemes throughout the coast".

The economic value of distributed ledger technologies (DLTs) is growing due to their implications for the future of payment systems. The advent of stablecoins has accelerated the development of central bank digital currencies. Is there a shift in the usage of stablecoins? Stablecoins started out as on-chain cash balances for crypto exchanges and traders, but they resemble a form of general-purpose money tokenized on public blockchains. It has to be taken into account that the business of crypto exchanges has been shifting toward institutional customers, as asset managers have adopted cryptocurrencies. Gordon Y. Liao[150] et al. reveal that,

> "since 2021, each dollar of payment stablecoin has supported approximately half the trading volume in cryptocurrency assets compared to each dollar of M2 money supply supporting traditional asset trading…the correlation between the growth of payment stablecoins in circulation and crypto asset returns is relatively weak, unlike the correlation found between trading stablecoins and crypto asset returns as well as the relationship between M2 money supply and equity market returns".

Hence, the rise of cryptocurrencies and decentralized finance raises central questions regarding the nature of trust and money in the digital area. Moreover, Raphael Auer[151] et al. argue that

> "the footprint of the current generation of cryptocurrencies does not mark a sharp departure from the existing financial ecosystem. Instead of relying on a trust-free—ie on-chain—environment, a new set of agents has come to the fore that is offering convenience, market access, transaction scale and liquidity to these markets in much the same manner as in commercial banking and securities trading, albeit without the same degree of regulatory and supervisory oversight".

Additionally, Mosioma and Walker[152] explain that, of the 16 leading cryptocurrency platforms, just four are subject to trading regulation. On the other hand, cryptocurrencies and their intermediaries, involving crypto exchanges, should be subject to the same kinds of regulation and oversight as economically equivalent asset classes and institutions, concerning financial stability, consumer protection, and AML/CFT standards.

Furthermore, it has to be taken into consideration that the degree of decentralization of DeFi platforms differs within the DeFi industry, and so, some intermediaries, known as systemically important crypto intermediaries (SICIs), have secured large market shares or offer critical valuation services to many DeFi Stacks. On the other hand, it is supposed that decentralized platforms have

appeared in order to avoid intermediaries via blockchain technologies. To that extent, the malfunction of the Terra-Luna stablecoin algorithm initiated a large-scale decline causing severe volatility of crypto-asset prices and so, the crypto industry suffered losses.

It is characteristic that in the cryptocurrency market materialized pump-and-dump schemes, a traditional form of securities fraud, and so, fraudsters use social media platforms such as Telegram, Discord, and Twitter to first spread false information and manipulate the price of low market-cap crypto assets, and afterward they sell their holdings to make a profit, triggering a fall in prices and investors to lose money.[153] In other words, it seems that "pump-and-dump" schemes are fraudulent practices encompassing the artificial inflation of stock prices through deceptive statements, and so, these schemes involve selling overvalued securities for a profit, leaving unsuspecting buyers with valueless investments. Moreover, "pump-and-dump" manipulation becomes profitable in the presence of technical traders, who manipulate information asymmetry and produce returns by raising prices and selling immediately. To that extent, stock prices increase as a result of information asymmetry and the influence of spammers. Dean Fantazzini and Yufeng Xiao[154] argue that detecting pump-and-dumps in real time implicates high-dimensional data, which means that AAI technology is the answer to any "pump-and-dump" scheme by detecting the anomalies via the speedy analysis of data and so prohibiting any insider trading from taking place.

It is worth noting that crypto asset trading is subject to laws combating money laundering, illegal imports, terrorist financing, and tax evasion; thus, leading digital platform operators in the United States and abroad have acceded to regulation as money transmission services.[155] John M. Griffin and Kevin Mei[156] reveal that

> "the "legitimate" crypto space commonly serves as the entry and exit point to the illegitimate space and in so is facilitating the cheap and easy flow of funds that is the lifeblood enabling both pig butchering and modern-day slavery. Overall, our findings suggest that criminal networks are moving substantial funds cheaply and without much fear of detection".

It is characteristic that Bittrex, Coinbase, and Binance, among the leading crypto exchanges in the world, found themselves charged with functioning as unregistered securities intermediaries in the United States, and the SEC assumed jurisdiction over a broad range of crypto asset platforms under the Securities Exchange Act of 1934, which means regulating crypto asset platforms and public trading in crypto assets.[157] The extensibility of digital ledger technology gives crypto asset platforms the potential to disrupt financial services. Moreover, crypto asset trading creates risks to the financial stability of the broader marketplace, which means that there is a need for proactively neutralizing new technologies' possibly destabilizing systemic consequences. Otherwise, there will be a need of backing up an uncontrollable and indefensibly self-referential financial system.[158]

2.11 Crypto Market Developments

It is characteristic that progress in digital technology for financial services has led to growth in markets for digital assets, with overwhelming effects on the protection of consumers, investors, and businesses, embracing data privacy and security, financial stability, systemic risk, and digital tokens. Moreover, the likelihood of switching from traditional markets to the crypto market has augmented systemic risk; thus, informed investors begin increasing investments in the market, trapping uninformed investors into the market and then dropping the price by cutting off demand. In other words, the crypto market functions as a shadow system of traditional markets, and so not regulating the crypto market means that the risk will merely travel from the regulated market to the unregulated one.

Originally, governments embraced a laissez-faire approach, leaving the crypto market unregulated and thus having to deal with the consequences of unregulated decentralized finance (DeFi), which is based on cryptocurrencies.[159] H. Y. Jabotinsky and R. Sarel[160] argue that "empirical analysis reveals an interesting pattern: investors initially shifted funds to the crypto market when the pandemic erupted, but then made a U-turn and diverted funds out of cryptocurrencies, leading to a plunge in the market."

For the reason that many cryptocurrencies behave as securities, the SEC began enforcing the usual securities regulations regarding disclosure on some existing tokens.[161] An incorrect interpretation of a token's current price is possible if investors rely on incomplete or false data, and so, herding increases systemic risk, which means that price bubbles arise and, simultaneously, bubbles are bursting when people herd in the opposite direction.[162] Thus, herding in the crypto market is expected as long as much of the relevant information required for correct pricing is dispersed. It has to be taken into consideration that the crypto market will either lessen systemic risk by granting investors an alternative during a crisis or exaggerate the problem through spillovers to other markets.

AI agents, by being autonomous software entities capable of adjusting, learning, and accomplishing multi-step functions, are restructuring economic formations and governance in decentralized settings. In addition, AI agents are altering how machines interact with their environments and execute missions autonomously, and so, their undertakings are extending from simple rule-based systems to high-tech entities powered by LLMs. To that extent, the current evolution in LLMs has inspired the design and functionality of AI agents.[163] The market for AI agents in the crypto economy is just arising; therefore, monetary values and monetary policy of states will be tested first in a global environment and later on the AAI society will give another substance to monetary value in a purely AI economy.

It is characteristic that within GOAT's introduction, the token's market capitalization rocketed and the spread of Terminal of Truths (ToT) not only epitomizes the power of AI agents to affect markets but also signals a quickly expanding "AI agent meta" within the crypto ecosystem and digital markets.[164] To that extent, Ante, Lennart[165] refers to the fact that "in October 2024, an AI agent known as Terminal

of Truths (ToT) stunned cryptocurrency markets by becoming the first such entity to achieve millionaire status through its holdings of the meme coin GOAT."

On the one hand, the prospect for abuse by AI agents offering investment advice generates matters of insider trading. On the other hand, due to the fact that AI and blockchain technologies converge, there is a demand for an effective, transparent, and equitable financial landscape.

2.12 Banks and Crypto-finance

Banks have the power to create the nation's money and credit, which they are entrusted to channel into productive economic uses, but the "money monopoly" and "money trusts" are one of the most dangerous forms of concentrated private wealth and a threat to economic freedom. Banks operate as the means by which monetary policy has an effect on the financial market, and so, bank regulation reduces the risks of intense competition,[166] but the concentration in banking accelerates concentration generally. It seems that formal bank mergers denote a dominant market position.[167] Hence, there is a need to apply all available anti-monopoly devices as part of a dynamic regulatory strategy. The government-granted monopoly on money creation rationalizes the bank regulatory regime's focus on conserving the public/private balance of power. Has this function been applied to cryptocurrencies circulation? It has to be taken into account that bank regulation and supervision prevent the over-issuance of money in relation to the needs and productive capacity of the nation's economy.[168] Has the emergence of cryptocurrencies and crypto assets averted/prevented the over-issuance of money? To that extent, S. T. Omarova and G. S. Steele[169] argue that "U.S. bank regulation operates as a comprehensive anti-monopoly regime, designed to prevent excessive concentration of private power over the supply and allocation of money and credit in a democratic economy."

It is characteristic that the continuing technology-driven shifts in the structure and operation of the financial system more and more call for a necessary modification in the paradigm of financial regulation.[170] Moreover, AI technological alterations in finance and the broader economy make the reconceptualization of banking law as an anti-monopoly structure a crucial part of any economic policy agenda.

It has to be taken into consideration that the digitization of financial services is not a value-neutral technological event; it is a political venture redefining financial and economic relationships in the AI era. Moreover, new participants modify the existing banking prototype and, in doing so, intensifying political-economy fears about anti-monopoly policy, which means that it is not merely containing the transaction-level technological revolution but administering changes in the distribution and exercise of structural authority in the financial markets.

So far, the advancement of fintech and crypto-finance has caused "shadow banking," whereby money creation and credit allocation are reproduced outside of the regulated banking system. Hence, shadow banking in fintech and the crypto market is running around the existing banking rules and regulations, while evading the constraints of banking law.[171] In other words, authorizing the growth of

private forms of money and money substitutes intimidates the sovereign public's capability to control the supply and flow of money and credit in the economy. Will states lose the power of money monopoly on behalf of a kind of financial NGOs operating in a "cloudy" environment and driving the globe on the road of merely accomplishing elite interests?

Most stablecoins are backed by US dollar reserves[172] or other safe assets, and so, it seems that private digital currencies necessitate access to the nation's full faith and credit. Hence, Stablecoins are collateralized by dollar bank deposits and government bonds from which they gain their value and capacity to perform as a private substitute for public money. Presently, dominant stablecoins are the central connecting means of crypto markets to the rest of the financial system. Thus, many crypto and fintech corporations link with regulated banks,[173] and so banks implement depository and back-office services on behalf of tech platforms.[174] Hence, the amalgamation of digital money into the conventional system will allow control of the quantity of money in an economy. It seems that insecurely organized "money trusts" controlling the flows of money, credit, and commercial goods and services via their platforms will generate problems shortly, not only in the flow of funds but also in the stability of the financial market.

Also, it seems that banks are developing their own digital-asset operations, stimulating unparalleled growth of digital-asset markets. Therefore, tokenization offers the opportunity to relitigate the appropriate boundaries and applicability of existing rules to financial products tendered in new packages and with new labels, which means that the production of new formulas of structural interconnectedness between crypto corporations and regulated financial institutions raises substantial fears not only about financial stability but also about excessive concentrations of authority in digital platform-based finance.[175] Also, the conglomeration of tech platforms, data, and finance facilitate possibly systematic anticompetitive practices such as tying agreements among digital platforms.[176] It has to be taken into account that platforms take on anticompetitive discriminatory practices when they do not permit competitors to use their facilities under the ordinary terms offered to others.[177] On the other hand, tech platforms are common carriers under the common law, and accordingly, in common law, reasonable deplatforming may be accepted.[178] It is characteristic that antitrust analysis and enforcement have been diminished to the technical application of "microeconomic models."[179]

It is characteristic of the power of the Apple Pay digital wallet to restrict its tap-to-pay functions for disfavored goods, causing prospective implications for the applicability of open banking regulations. Additionally, tech finance platforms can engage in unfair pricing and manipulation of consumer behavior, utilizing competitor information by using their data and market power to entrap consumers.[180] It has to be taken into account that digital custodians offer a 500 billion USD digital-asset market under their terms and conditions for crypto custody and wallet services.[181] To that extent, the MiCA rules on crypto custody link protection first to the custody of crypto assets, which then embraces the upholding of clients' rights and the avoidance of their reuse.[182] Also, corporations are striving in the safeguarding and transacting of digital assets, whether it be from operational complexity, security,

or reputational risks. Moreover, Zodia[183] Custody's Software-as-a-Service delivers bank-grade digital-asset technology services to customers by providing the flexibility and functionality required to succeed in a digital-asset economy.

It is characteristic that only a few custodians specify guidance to their customers on the applicable law and jurisdiction, and so, crypto has been distinguished by an absence of regulation involving contractual freedom, which means that financial regulation will be central to boosting investors' confidence in crypto and causing merit-based competition among providers. In line with this, D. Zetzsche and A. Nikolakopoulou[184] argue that

> "Many crypto custodians use misleading terminology, thus blurring the true extent of their accountability and liability with respect to their services. Moreover, the lack of transparency regarding the custody policies, and in particular the key storage mechanism, is a widespread practice in collective custody that carries serious risks for investors".

In the end, many digital-asset custodians have been escalating their responsibilities from the safekeeping of cryptocurrencies to assisting customers in taking part in new business openings and asset classes, such as DeFi, NFTs, and metaverses.

2.13 Corruption and Tax Evasion

Corruption is acknowledged as a societal happening totally embedded in modern social interactions, escalating during transitional periods and encompassing practices like the sale of parliamentary seats, turning corruption into a tool for corrupt individuals within the system, which means that corruption illustrates a confrontation to institutional transformation. Hence, there is a need to promote transparency and accountability via a more effective procurement process. It has to be taken into consideration that corruption damages institutions, influencing the credibility of states. Public and private sectors are part of corruption, and so, the public sector corruption denotes the misuse of public office for private benefits.

It is worth noting that corrupt dealings arise via a cost-benefit trade-off encompassing the tension between public agents' private interests and the general interest. Moreover, corporations' decisions to participate in corruption correspond to their objective of profit maximization, which means that corrupt dealings arise out of the dominance of profitability objectives over the societal value of ethics. Corruption in some societies denotes ethics and trust prevailing in their existence. To that extent, Chaudhry Anwar and Shabbir, Ghulam[185] argue that

> "the socio-political and religious norms are so weak that they cannot affect the corruption level in these countries…Therefore, perceived level of corruption is not affected by the religion…government should focus the economic factors to curb the level of corruption".

For instance, corruption in the pharmaceutical system influences a state's entire population, and so, governments must establish sound institutional structures for

implementing anti-corruption measures, processes, and policies in strengthening public welfare. Hence, corruption is reduced if institutions are transparent, public scrutiny is high, and the law and administrative processes are enforced properly by public officials. To that extent, Jillian Cohen[186] et al. write that

> "The consequences of corruption within the pharmaceutical system are unfortunately fairly easy to identify. If quality control regulations are not sufficient or are not implemented or enforced, health and economic consequences result. At an extreme, unsafe counterfeit drugs can lead to severe health consequences, including death".

Corruption is a substantial threat to national security, and the only way to successfully respond is to make certain the well-organized functioning of government bodies, strengthen national institutions, and considerably diminish the frequency of corruption.[187] Moreover, corruption and inefficiency in public services are related to weak governance and so illustrating the ethos and attitudes of the political and bureaucratic executive. Moreover, government policies, investment and financing decisions, customer-interfacing activities, commercial operations of the utilities, procurement, and human resource management are key fields prone to corruption. Moreover, corruption in procurement and contracting generates problems in many sectors of an economy, requiring an anti-corruption strategy concentrating on transparency and competition in procurement and contracting by externalizing accountability of public officials via public participation and independent regulatory institutions.[188] Also, corruption reroutes funds to projects with lower economic rates of return, and so, corrupted construction is dropping project sustainability and escalating the need for maintenance and rehabilitation.

It is worth noting here that combating corruption is about advancing governance. In fact, the implementation of AI systems dealing with electronic transactions means that AI can easily spot unusual transactions, which means that AI can contribute in dropping corruption. Government modernization via datafication and digitization offers the means for battling corruption because datafication and digitalization are central mechanisms via which regulatory managerialism functions.[189] Corporations participate in lobbying efforts to influence laws and trade with foreign countries. In line with this, Transparency International has criticized the absence of safeguards against lobbying, requiring international initiatives to stimulate public administration by stressing government transparency which means that there is a demand for coordinated efforts across all government entities throughout the countries and the presence of wide-ranging anti-corruption strategies.[190] Thus, merely establishing an anti-corruption agency is inadequate, and so, full commitment and cooperation from all government bodies is needed.[191]

It has to be taken into account that political institutions adjust the relationship between interest groups and policymakers and so generating different patterns of mobilization and lobbying strategies. Corporations are adapting their lobbying strategies across different countries based on institutional differences.[192] It seems that via lobbying access to decision-makers and influence on policies are traded

against information and support. Also, lobbying is targeting legislators.[193] In line with this, J. Lee and J. Stuckatz[194] notify that

> "interest groups that lobby across countries likely benefit from tailoring their lobbying strategies according to local institutions, and by strategically coordinating the activities of the parents and foreign subsidiaries. In fact, we find evidence that many multinational corporations that engaged in USMCA lobbying actually lobbied from both the US and Canada by utilizing their subsidiaries".

Weak state administration that comes forward when an individual or organization has monopoly power over a good or service, discretion over making decisions, and limited or no accountability generates corruption, and so, individual economic success is not resting on market forces. It has to be taken into account that corruption accelerates economic growth by disabling unproductive allocation of resources stemming from weak institutions.[195] To that extent, Chaudhry Anwar and Shabbir, Ghulam[196] argue that

> "increase in economic freedom, globalization and average level of income have reduced the level of corruption in these countries. But the level of corruption in developing countries is increased with the increase in level of education. The income distribution has not significantly explained the variations in the level of corruption for the countries in the sample".

The quality of institutions advances the effectiveness of government expenditure and, in doing so, fostering economic growth. Naftaly Mose[197] argues that "the effect of government expenditure on growth is largely indirect through democracy and corruption. The results also show that the interaction of both democracy and corruption on government expenditure dampens economic growth."

In general, corruption produces substantial distortions in the use of public resources to the detriment of society and so damaging democracies and the rule of law.[198] In other words, institutional corruption and conflicts of interest in tax law policymaking indicate the way that corruption affects policies against tax abuse, along with upsetting the rule of law and causing a distortion of justice. Hence, tax evasion and corruption are interrelated incidents causing harm on a global scale.[199] To that extent, corruption of tax officials is a substantial determinant of tax evasion. Additionally, tax havens, offshore centers, and free ports perpetrate tax evasion and tax avoidance.[200] Regarding tax evasion offenses, L. Winter and D. Vozza[201] argue that

> "a promising solution may lie in the introduction of a Convention Against Tax Evasion (CATE)…The convention would also offer the opportunity to send a clear message to corporate players and other sophisticated taxpayers who currently exploit the fragmentation of the international landscape about a new-found willingness to prevent and counter such illicit behavior".

Globalization has transformed and intensified corrupt practices and tax evasion.[202] It has to be taken into account that tax evasion harms state revenue and necessary investments in society. There is no international legal mechanism responding to serious tax evasion and tax avoidance behaviors from a criminal law perspective.[203]

It seems that residual corruption, which is not linked with other governance indicators, advances economic growth in countries where the institutional quality is inadequate, and so, corruption clearly influences GDP per capita growth.[204] Also, economic growth denotes a country's macroeconomic stability. In other words, the powerlessness of weak governments to inspect their institutions instigates a high level of corruption that harms growth irrespective of its impact on investment. Moreover, the substandard characteristics of institutions make the influence of corruption on growth more damaging.[205] In line, Joël Cariolle[206] denotes that

> "Multi-level estimations stress that the negative effect of income per capita on bribery is found to be mostly driven by improvement in human capital, more particularly by the decline in fertility rates. They also allow the reconciling of some contrasting findings of the literature on other corruption determinants, but point that the contribution of corruption determinants is context-dependent".

It has to be stressed here that the effect of corruption on growth is experienced some time prior to any variation is monitored in the corruption score.[207] Moreover, the link between transparency and growth is direct with transparency leading to economic stability, greater investment, and growth.[208]

It is characteristic that corruption is an element triggering phenomena of "Arab uprisings"[209] which means that corruption enhances economic growth by overpowering bureaucratic obstacles. In other words, corruption is utilized as an alternative to competitive bidding in purchasing government licenses, which also spreads bureaucratic slowness. Fatih Kırşanlı[210] mentions that

> "The MENA region suffers from informal corruption practices such as wasta (networks and reciprocity) and hamula (clientelism). In the wasta system, citizens who have connections can quickly process their documents through the government bureaucracy and help their close ones get hired for a job".

Given that political institutions greatly influence investment and growth, governments should exploit their resources to lessen corruption in political and bureaucratic domains. It is worth noting that corruption acts as a strong impediment to economic activity, twisting public spending decisions and undermining the quality of infrastructure. To that extent, Fatih Kırşanlı[211] mentions that "Eliminating corruption and boosting economic growth simultaneously will provide opportunities to lower corruption further, improve institutional quality, and sustain the economic development of each MENA country." In general, it seems that corruption destabilizes the economic, physical, and social setting in which people make their production and consumption decisions, thus undermining factors of development such as the tangible infrastructure of a modern economy and the intangible capital.

Are corporations forced to follow corruption tactics in order to survive in a corrupt environment or to enter into a sovereign state? It seems that, on many occasions, corruption is good for an economy, permitting corporations and individuals to circumvent or expedite regulatory requests that are too costly or slow. Also, a capitalist who is balancing the costs and benefits of starting a business in a corrupt state calculates possible "bribes" they have to pay to those issuing licenses, to tax inspectors, etc., due to the fact that corrupt officials will affect profits and any generated intellectual property of the investment. Hence, capitalists and innovators in a corrupt country may not have much faith in the rule of law, which means that starting a business or investing in innovation in a corrupt country is riskier and carries extra costs.[212] First of all, it seems that established corporations gain from corruption at the expense of the economy, particularly in order to survive in a corrupt setting when bribery and other kinds of corruption twist competition. Nonetheless, established corporations face extra costs from functioning in a corrupt environment, and thus, extra risks arise for them due to inadequate local knowledge and laws imposing noteworthy fines. Many corporations are not aware of the extent and depth of corruption until illegality or misconduct is revealed, and so, corruption interferes with the assessment of costs and benefits for new business establishments and investment decisions. In line with this, Robert Gillanders[213] refers that "corruption can grease the wheels of an economy that is subject to poor governance and overregulation…corruption is harmful to economic development. While bribery may help some firms to overcome costly and inefficient regulation, corruption is a cause of red tape."

It is worth noting that corruption may lead to projects that are of no benefit to the public, offering profitable contracts for connected individuals, which means that corruption may alter the composition of public expenditure, dropping trust. Also, the risk of corruption prevents innovation, hindering competition. In other words, corruption diminishes the extent and competence of public and private investment, prohibiting beneficial trades.

As mentioned earlier, corruption is a means of employing public powers to accomplish private objectives. Moreover, corruption takes place when there is a monopoly of power, restricted responsibility, and power to make judgments. To that extent, legal reforms and social changes reduce corruption. Will AI spot and detect properly corruption tactics? To that extent, AAI systems can be employed in monitoring matters of corruption and its impact on investment and growth, thereby permitting an automatic identification and fixing of any mismatch on behalf of competitive implementation. In line with this, Joël Cariolle[214] denotes that

> "multi-level estimates support that economic development, measured by income per capita, significantly and negatively contributes to bribery prevalence…Last, estimations emphasize the direct and indirect effects of democratic institutions on bribe prevalence, and also stress contrasting evidence: while increased political rights and media independence have, as expected, a significant deterrent effect on corrupt transactions, greater civil liberties are found to foster bribery".

Hence, the introduction of AAI technology running objectively will spot easily matters of corruption and will automatically repeal any transaction grounded in corruption and not in the rule of law.

On the other hand, in certain contexts, corruption augments efficiency by upsetting the scales of cost, advancing economically beneficial activities. In other words, corruption is beneficial in "greasing the wheels" of the economy in that way stimulating competence and effectiveness in the economy, particularly for developing countries with weak institutions.

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3 AI, Financial Governance, and Management

3.1 AI, Corporations, and Management

First of all, implementing advanced technologies, the operative use of data and analytics, and guaranteeing flexibility and responsiveness to rapidly changing market settings are vital matters of management. Moreover, management in globalization is a crucial aspect of the activities of modern corporations because globalization instigates amplified international competition, expansion of global markets and opportunities, along with shifting conditions and necessities for management practices.

The efficiency and effectiveness of information increase both production and management and so a better information scheme augments the users' motivation. It must be taken into account that the adjustability of the management process has a major and significant role not only for the technology providers but also for the customers. Hence, the appropriate management process must have the qualities that aid the efforts and purposes of both parties involved in a project.

It has to be taken into account that industrial organizations need revolutionary changes to remain competitive, such as fulfilling customer expectations and facing unprecedented competition. Additionally, technological development remains the biggest challenge. Hence, industrial organizations are transforming themselves to achieve operational efficiency by launching new digital technologies and altering their management systems. Nevertheless, industrial organizations need strong leadership to endorse transformation successfully. Can AI become the leader for advancement in society? Of course, the AAI technology will employ a central AAI system that will make leading decisions and, thus, play the role of the leader wherever decisions are made for the particular community.

It could be said that digital transformation (DT) improves organizations by generating considerable alterations to their properties through combinations of information, computing, communication, and connectivity technologies. Also, DT allows industrial organizations to make a central move from a traditional organization to a digitized organization, making it possible to develop agility, collaboration, innovation, and improved customer experience, as well as reorganizing operations by embracing new business models. Consequently, DT is not just about the introduction of new technologies; it incorporates a holistic transformation largely of organizational properties to gain all the benefits it offers. Also, there is a need

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for optimization between new technical and management systems. In other words, digital technologies assist leaders at work by utilizing digital technologies to boost real-time feedback and performance improvements, and, at the same time, comprehending the multifaceted flows.[1] Hence, all these functions will be managed by an AAI system arranging the whole function of a particular company, organization, or a society and a nation.

Leadership competencies are the knowledge, skills, and abilities needed to accomplish their jobs skillfully.[2] Can a super AAI system become the leader of the globe? Of course, in an AAI world with AAI humanoids living an electronic life, they will be governed by a central AAI system controlled democratically by a team of AAI humanoids. Additionally, the continuous advancement of AAI technology will modify the capabilities of AAI humanoids, which means continuous progress in AAI life, society, and the legal and economic environment.

It is characteristic that AI in management shows that humans shape AI systems' behavior, and so, managers define the objectives, set constraints, create, and pick the training data, which means that by offering AI systems with feedback, humans shape and reshape algorithms through their daily actions and interactions. Has AI become a device in the hands of CEOs to manipulate instead of objectifying the management process? Raisch and Krakowski[3] suggest that "if organizations adopt a broader perspective comprising both automation and augmentation, they could deal with the tension and achieve complementarities that benefit business and society."

It is worth noting that the digital era is marked by rapid social transformation, accelerating global interaction and the law enforcement management. Management is gradually acknowledged as an indispensable tool for promoting harmony and order in the pursuit of mutual objectives. Moreover, utilizing a systemic tactic in management activities contributes to the further advancement of the management system in the law enforcement field, the development of its flexibility, and adjustment to fast and vibrant social developments. System analysis lets taking into consideration various factors, conditions, and internal and external issues, including political, economic, social, and technological factors influencing the relevant activity positively or negatively. Also, the management process transforms process inputs into outputs using appropriate resources. AI systems and information technologies enable the formation of expert systems that accumulate information and model the examination process, thus allowing the execution of law enforcement functions and the provision of management courses. Hence, flexibility and adaptability enable law enforcement agencies to be more responsive and proactive in the face of rapid social change. Medvedenko, N., and Medvedenko, O[4] argue that "The integration of different perspectives and interdisciplinary knowledge is crucial for promoting a more robust and responsive law enforcement management system."

3.2 Algorithmic Governance

The increasing popularity of AI has stimulated intergovernmental, national, and regional organizations to construct strategies around AI governance. The

governance of AI technologies has become essential for governments across the world.[5] AI governance implicates the whole digital ecosystem. Thus, it is characteristic that there is no single object of AI governance but rather a diverse collection of machine learning applications performing different rationales, which means that AI necessitates systemic control of other digital ecosystem components.

The term "governance" concerns an organized way correlated with formality, through which modern capitalist societies and market economies are founded which means governance allows for efficiency, embracing norms, legitimacy, and sustainability of social order. It must be taken into account that governance has gradually become algorithmic in its reliance on computation, while increasing its scale consequences over populations and territories which means that algorithms have been progressively accepted in evaluating businesses. Credit algorithms evaluate consumer behavioral data, generating a predictive score denoting the soundness of a business in its future transactions. It is characteristic that algorithmic governance encompasses "the intentional and unintentional steering effects of algorithmic-selection systems," and so, algorithmic systems touch the key characteristics of various governance processes, leading to new patterns and new governance methods. Hence, algorithms are instruments of governance needing regulation and governance of them.[6] On the other hand, AAI technology will administer the algorithmic function according to the rules of the AAI application in various aspects of AAI society.

DAO governance is decentralized, upholding a direct governance model, where stakeholders have decision rights relative to their ownership of governance tokens. Also, all decisions and governance actions within a DAO are documented on the blockchain. Furthermore, the decentralized nature of DAO governance offsets insiders' ability to exert operative control over decision-making processes.[7] Moreover, the transparency of blockchain technology restricts the profitability of insider trading, thereby diminishing insiders' incentive and capability to engage in opportunistic trading. It is characteristic that when trading is driven by insider information, governance influencers buy tokens before proposals that influence token prices, thus producing unusually positive returns which means that proposal managers increase their token purchases before the formation of value-enhancing proposals. Also, information asymmetry in DAOs permits stakeholders with confidential access to exploit less-informed investors. To that extent, Cong, Lin[8] et al. argue that

> "significant abnormal trading activity around governance proposals…proposal managers engage in insider trading—yielding an average market-adjusted return of 9.5%. The combination of concentrated voting power and insider trading can be value-destroying in the long run, particularly during times of crisis when governance becomes central to the survival of business organizations".

It also seems that insider trading is higher in small DAOs, and the profitability of insider trading decreases in the case of restrained blockholders' voting power.

It is worth noting that the privatization of governance is attributable, in part, to governments' absence of technical expertise, along with the flexibility needed to tackle complex regulatory tasks. It is worth mentioning here that there is a gap between the state's technological capability and that of private corporations, echoing the point that governance and law "lag" behind technological advancement.[9] In fact, privatization is the foundation for increased private provision of public services due to the fact that technological developments force states to resort to the best of private innovation.

Governments govern alongside private and civic sectors in a more inclusive, collaborative, and dynamic way via inclusive and transparent processes.[10] Global AI governance is unstandardized and is gradually and iteratively being formed and reformed. Numerous global standard-setting bodies are engaged in their own initiatives to standardize and tackle particular regulatory standpoints of AI governance.[11] So far, the power of AI technology seems to have been used enormously by sellers, and thus, pricing and data will be a central area of policy in an AI-centric world. AI advances the capability to predict revenue outcomes of different policy options. The opacity of algorithms used by the administration has become a political matter and has also triggered growing case law and legislative changes.

Furthermore, AI is a transformative technology generating significant risks and challenges; thus, there is a growing demand for operative governance frameworks to ensure safe and responsible implementation, which means that IP law is part of sound AI governance. Moreover, IP rights supplement regulatory objectives by offering economic incentives for innovation, fostering knowledge dissemination, and advancing policy means in supporting AI governance principles. In line with this, Dennis Crouch[12] argues that

> "IP should play a supporting role in AI governance, not be the primary legal and regulatory lever. While IP rights can help incentivize beneficial AI development, they are not well-suited to address the full range of risks and challenges AI poses".

Given that norms, laws, numbers, and computer code offer a computational procedure, they are elements of "governance by algorithm." It is argued that laws and social norms preserve a non-calculable and non-algorithmic element that cannot be programmed into the current AI codes, but the forthcoming AAI technology will allow AI codification encompassing formalized evaluations.

It has to be taken into consideration that law can be expressed via algorithms since laws can be formalized.[13] To that extent, regulatory ranking and credit-rating systems run on step-by-step instructions to assess compliance performances and risks using statistical calculations which can be programmed into FinTech or RegTech algorithms run on computers.[14] AI algorithms decide credit scores or criminal sentencing and probation periods.

It seems that RegTech technology assists in checking of financial market participants who are becoming increasingly disintegrated by the emergence of new FinTech startups; therefore, higher reporting accuracy and diminished compliance

costs are vital incentives.[15] Also, due to RegTech, the processes and capacity for the supervision of financial systems are transformed. In line with this, Douglas W. Arner et al.[16] argue that "the transformative nature of technology will only be captured by a new approach at the nexus of data, digital identity, and regulation." It could be argued that the introduction of AAI systems in an AAI economy run by AAI systems controlled by AAI humanoids acting objectively and not controlled by any other entity will achieve an automatic modification of financial regulations according to the latest developments in AI technology fitted to the demands of the AAI society and its AAI economy.

It has to be taken into account that digitalization produces information assets beyond the processing capability of human intelligence, and so, matters will be dealt with via AI systems, which means that algorithms identify the modes in which software activates information assets to reach specific ends. Moreover, it has to be taken into consideration that implementing algorithmic systems generates a shift toward a special form of design-based governance, with power implemented ex ante via choice architectures outlined through protocols, necessitating lower levels of commitment from governing actors. AI technology lifts the concentration of algorithmic calculation from the simple processing of specified complex rules to the dynamic use of self-adjusting data patterns, thus optimizing financial processes. It is characteristic that the governance-related functions accomplished by algorithmic systems in the field of FinTech are apprehended by the use of algorithms as a channel for enabling governance procedures, with higher emphasis on the input of algorithmic systems and the fact that algorithmic systems have a high degree of independence in making and enforcing decisions.

Also, algorithmic systems handling collective action problems alter the main characteristics of governance and, therefore, improvements in technology have permitted control and automatic resolution of matters such as speeding, which can be monitored and even sanctioned through automated systems using algorithm-driven databases to recognize speeding cars and issue fines.[17] Daria Gritsenko and Matthew Wood[18] show that "algorithms increase efficiency while decreasing the space for governing actors' discretion. Furthermore, we compare the effects of algorithms in each of these cases and explore sources of convergence and divergence between the governance modes."

Currently, algorithms are a part of everyday life, and from airport flight scheduling, credit checks, and financial trading decisions, algorithms have become central to analysis and decision-making. Algorithms in public governance have been recognized as a powerful instrument for expanding the efficiency and effectiveness of government through automation and new modes of coproducing public services. Also, algorithms are employed in making quick decisions, thus augmenting economic productivity, simplifying social interaction, and illustrating social issues, such as the low-carbon energy transition. To that extent, computation is a key medium of governance with the recent breakthroughs in AI. Regardless of the modes of governance, governance by law is the cornerstone of implementing any kind of governance. Furthermore, the governance of AI technologies has become fundamental for governments across the globe.

On the one hand, law conforms to social norms in order to be accepted and enforced. On the other hand, governance by numbers is an institutional extension of governance by laws, in which number-based statistical analysis develops into the central medium for governing, embraced by either public or private actors. Moreover, statistical techniques are employed by nation-states in legislative, public administration, and judicial decision-making. Correspondingly, in global governance, statistics is accepted and applied by decision-making bodies in international organizations or private entities. In other words, governance by numbers diverges from governance by laws in its character of using statistical analysis and interpretation in place of legal interpretation, but it seems that using statistical analysis is encompassed in various legal rules of corporate and competition laws. Additionally, governance by code, created via data and law, represents an evolution of modes of governance, being a computational mode of governance implementing the "algorithmic turn" from norms to laws, laws to numbers, and numbers to code. Hence, code achieves greater scale outcomes than all preceding modes of governance due to processing big data encompassing numerical measurements of empirical statements, which means that the data that code depends on are still just like numbers, and so governance by code has to be cognitively founded on laws and social norms. In other words, the regulating code will encompass the latest data on matters that are continuously updated.

3.3 AI, Governance, and Decision-Making

The use of modern communication and collaboration of AI technologies allows corporations to maintain effective interaction with global partners, denoting the necessity to develop communication management competencies and adjust to different contexts in order to perform profitably in a global environment.[19]

On the one hand, digital platforms have redefined business models, and well-known industries have launched new products and services, generating value for society. On the other hand, platform owners have gathered extensive power and influence, playing critical roles in leading major stakeholders to produce value for their platform ecosystems which means that, due to the absence of good checks, platform owners direct digital platforms to engage in activities that benefit themselves at the expense of other stakeholders. Hence, in a fully centralized governance model, platform owners possess sole governance control, allowing them to model governance progressions and outcomes.[20] Thus, centralized governance disfavors by isolating platform participants and so, platform owners select their own interests over those of stakeholders. Besides, in a fully decentralized governance model, platform contributors collectively experience full governance control, allowing them to stand for their standpoints. Thus, decentralized governance boosts incentive compatibility and informational competence, allowing digital platforms to adjust their governance processes and overall platform operations. To that extent, The Shop Safe Act 2020[21] incentivizes platforms to engage in a set of best practices for investigating sellers and goods and penalizing repeat offenders and so making certain that customers have the best information available to them when they make

their online procurements. Moreover, consumers rely on digital platforms to guarantee safety because they trust that the platform delivers the products.

It is worth noting that economic issues such as modifications in global markets, trade agreements, and currency fluctuations have a noteworthy effect on the financial condition and strategies of corporations. Moreover, variations in consumer habits, demographic trends, and cultural differences influence the market condition and the perception of corporations' products and services. Additionally, climate change, energy competence, and environmental standards are vital for corporations, forcing them to pay attention to sustainable development. Also, the digital economy generates new opportunities for economic growth while minimizing environmental effects and thus advancing sustainable development. Rosário, A.T. and Dias, J.C[22] argue that

> "The digital economy has played, and will continue to play, a crucial role in sustainability, supporting the more efficient use of resources, optimizing energy use in buildings and factories, reducing food waste in supply chains, and improving the efficiency of transport networks…the digital economy is increasingly recognized as having an essential role in promoting sustainability".

As mentioned earlier, globalization activates increased international competition, expansion of global markets and opportunities, along with altering settings and ratios for management practices, which means that corporations have to adjust to these changes and implement new management approaches in order to remain competitive. In line, Pashchenko, O[23] et al. argue that "globalization creates various challenges and opportunities for organizations. The introduction of new approaches to management is necessary for an effective response to changes in the global environment and ensuring competitiveness."

The rise of digital technologies and social media is forcing corporations to reassess existing business models, as well as how they organize themselves and structure corporate governance. It could be said that existing regulatory approaches are failing business organizations, and many corporate governance rules and regulations are programming institutions to be dysfunctional. Hence, there is an ever-widening gap or disconnect between regulatory strategies and the business needs of corporations operating in fast-moving, technology-driven markets. Accordingly, many businesses and other organizations are ill-equipped to meet the challenges of today's digital world, which means that there is a need to design regulations that incentivize corporations to set up the organizational structures and practices that will permit them to thrive. It could be said that new corporate governance focuses on supporting a company's ability to innovate, which means promoting compliance and risk management.[24] Also, shareholders and investors have gained increasing power and influence over their corporations' activities, enabling them to affect corporate governance.[25] Moreover, better corporate decision-making leads to higher cash flows available for shareholders.[26] To that extent, Kobi Kastiel and Yaron Nili[27] argue that "While the largest firms are making strides in adopting

corporate governance arrangements that are viewed as socially and economically valuable, many smaller firms are not."

AI systems are exposing the public to major new risks from flawed or biased AI, and so, AI results are influenced by the inappropriate use of a person's race, sex, gender identity, religious beliefs, political affiliations, and other personal attributes in making critical decisions. Hence, corporations have to utilize AI systems to assess the impacts of applying automation to these critical decisions.[28]

AI technology is transformational, demanding new leadership skills and requiring an alteration in the governance of a company. Moreover, the unsettling capabilities of AI are putting business leaders and technology executives under more pressure to produce business value than ever before. Additionally, the implementation of AI across a company is focused on detecting and supporting the right capabilities, addressing competing priorities for AI investment. Advancements in AI have already reached the level of a foundational technology component for companies, shaping business strategies across all dimensions, such as automation of business processes, transformation of customer experiences, and presenting new products and service offerings. Hence, business executives and technology leaders need to assess their business and technology landscape and then determine the appropriateness of AI-led interventions or supplements.

Likewise, blockchain stipulates a way to exchange value-embedded data without friction and with trust, making the data secure and ensuring that it is used for the intended and previously agreed-upon purpose. AI algorithms play a part in automatically archiving using data sharing techniques to make blockchain more resourceful and scalable, while blockchain is initiating a decentralized network for independent verification of claims. Hence, AI algorithms automatically trace and analyze data from business operations and work tasks, generating insights that assist in monitoring and evaluating corporations' performance.[29]

AI programs utilize huge amounts of data, producing novel insights and automating repetitive tasks. Great opportunities for optimizing existing procedures and enabling new ones are offered, which means a higher competitive edge for businesses. The effectiveness of AI technologies is accurate by the data they have access to; therefore, companies must look at their existing inward-looking data strategy and open up to develop strategic alliances based on data sharing. Hence, AI offers faster decision-making. Taking into account that nowadays every business is a digital business, it means that the speed of alteration in business circumstances and the capacity to adjust to transforming conditions compel a speed-up of companies' decision-making process. Hence, with AI-powered pricing, a company modifies the price of products according to demand or competing market conditions. Algorithms deliver the exact outcomes each time based on data.

AI enhances strategic decision-making by analyzing capital allocations. In addition, AI is furthering operational decision-making by analyzing internal processes and systems and assessing employee productivity while highlighting inefficiencies. It must be taken into account that through automation, identification and resolution activities are advanced, solving more issues in a given time or with a given set of resources. Additionally, algorithms automate the process of analyzing and linking

event data. Furthermore, correlating customer profile information with financial processing applications and transactional data to identify outliers and highlight performance-affecting factors is achieved through automation generated by AI. Likewise, AI automation facilitates the evaluation of unstructured data in services and sorting workloads for optimal infrastructure placement, along with correlating incidents to determine the production effect of infrastructure and application changes.

AI addresses the central business goal of faster time to market and, with data progressively available to support all the information that goes into a loan processing application, it noticeably diminishes the time needed to process the loan. Hence, the business strategy is advanced via technology embedded in business processes.[30] AI deals with tasks that necessitate creativity and intelligence, such as composing music, performing facial recognition, detecting emotions, interpreting, and extracting insights from images, machine-generated data, text, and unstructured data. It must be taken into account that data are not protected by copyright because they have "nothing to do with the creative artistic assets that copyright laws serve to protect."[31] On the other hand, the Supreme Court has protected data sales under the First Amendment[32] and trade secrets as a corporation's property, denoting the possibility of protecting data as the property of its collectors.[33]

In fact, amalgamating AI innovations into corporate governance adds to improving decision-making, enhancing operational effectiveness, and gaining strategic leverage while considering legal considerations. Hence, ML, NLP, RPA, and big data analytics enrich conventional governance frameworks by augmenting workflows and accelerating smarter, data-centric decision-making. It must be taken into consideration that board dynamics, risk oversight, compliance, clarity, and stakeholder engagement are influenced by AI; thus, AI transforms board dynamics by permitting more data-infused control, allowing corporate boards to perform efficiently and avoid risks in their strategic selections. Hence, AI-driven analytics offer prompt insights into risks, stimulating active risk management tactics; therefore, compliance mechanisms are augmented by AI because AI systems systematize adherence to changing regulatory landscapes, which means reducing the risk of compliance failures while augmenting transparency and accountability.

In fact, AI systems via neural networks are affecting today's technology landscape, forming intelligent systems that evaluate vast amounts of data in order to make predictions. AI has advanced the capacity of technology to autonomously expand its performance and adjust to new data, tasks, and environments, which means that the forthcoming AAI systems will allow AAI humanoids to act like humans with more capabilities and intelligence. Even the current AI systems imitate and extend human intelligence.

3.4 Financial Data Governance

Financial data governance involves a variety of rules and principles regulating the production, acquisition, use, and circulation of financial data. To that extent, D. W. Arner[34] et al. argue that

> "financial data territorialization is likely to increase. This may in fact be reinforced by the wide use of sanctions operationalized through digital finance as a result of the Russia-Ukraine war. The trend may be further reinforced by the opaqueness of financial flows stemming from new fintech solutions, which need to store data where that data can be controlled. A multi-layered solution is required to facilitate essential cross-border access to financial data and digitalized services."

First of all, harmonization of processes and rules regulating the assembly and transfer of data is required. The current AI can help in harmonizing data transfer, but the forthcoming AAI necessitates the harmonization of data transfer. Notably, the AAI technology will automatically harmonize data in order to handle the AAI functioning.

Regulation and private law concerning data will have consequences for the financial system, while financial regulation must handle the digitalization and datafication of finance. Hence, policymakers, regulators, and market participants have to reconceptualize financial data and financial data analytics, shifting from the rules and processes based on centralized control toward solutions grounded in decentralized approaches.

3.5 Capital Management

Capital liberalization has promoted growth.[35] The cost of capital reduces when there is an escalation in the degree of globalization.[36] In addition, financial liberalization places a state in a more vulnerable position to financial crises; therefore, financial markets and institutions must introduce regulations enabling macroeconomic stability before capital flows are deregulated. Joseph P. Joyce[37] considers that

> "A more liberal *de jure* capital regime lowers the incidence of banking crises. FDI also lowers the duration of banking crises, but a less regulated capital regime is associated with crises of greater duration. Financial globalization does not seem to be directly associated with the costs of the crises, but currency crises are linked to higher costs."

To that extent, management necessitates stronger internal controls for securities transactions; however, implementing such controls is costly to design, implement, and supervise.[38] It must be taken into account that the need for digitalization resources is leading to an environmental chasm due to the fact that cryptocurrencies' electricity consumption is high.[39]

It is worth noting that working capital management implicates the management of current assets, current liabilities, and the interrelationship between them. In addition, net working capital is the difference between current assets and current liabilities, being a financial indicator that can be utilized in conjunction with ratios to assess the liquidity of a corporation. Thus, adequately enough, net working capital is considered advantageous since it implies that the corporation has abundant liquidity to meet its short-term obligations. In reality, one of the objectives of cash

management is to diminish superfluous or redundant net working capital to a minimum, thus reducing the cost of holding inactive assets.

It has to be taken into account that capital and administrative costs propel profitability regardless of whether national banks, credit unions, or FinTechs offer the cash management utilities. Moreover, regarding the effect of cash management on firm profitability, it has to be indicated that, firstly, corporations have access to cash management and, secondly, corporations have banking access, which means gaining access to both the lending and the cash management functions.

Nonetheless, cash flow management is not a rare mission in the normal process of a business but is profoundly implicated in every part of business management. Thus, any and all management endeavors have to fulfill cash flow ratios while managers try to accomplish the other objectives of the corporation. Hence, cash flow accomplishes survival, profitability, growth, the formation of shareholder value, and, conclusively, the resourceful use of corporate resources.

It is characteristic that the management of cash flow is fundamental to the triumph of every company, whether it be public or private. In fact, cash management is more decisive to the success of a company than making an individual sale or offering a service for a period of time, which means that cash management enhances the advancement and employment of integrated financial strategies for the entire corporation. Furthermore, the rationale of cash flow and working capital management has turned out to be an essential element of the entire establishment, and so, the objective is no longer to exploit cash flow or minimize inactive cash but rather to ensure the availability of cash in the form and amount needed for the continuing function of the company and to warrant an addition to shareholder value. Moreover, the cash management system has to keep up with the rapid development and its attendant upsurge in risk. Hence, an effective financial manager has to balance the multiple goals of the corporation, utilizing the corporation's resources efficiently. Thus, the effective management of cash flow is required to accomplish the multiple goals concurrently, and so, the cash flow planning process is a very dynamic one.

Cash flow unpredictability leads to internal cash flow shortfalls, which in turn lead to higher costs of capital and forgone investments. Companies capable of minimizing cash flow volatility are able to invest more.[40] Even though a state holds foreign reserves in its own banks, governments often decide to keep their reserves abroad to circumvent costly cross-border transactions and gain direct access to foreign currency and debt markets. The strength of a currency is rooted in faith, and secondary market liquidity for a debt issuer lowers the cost of capital. Moreover, financial hedging instruments are broadly used by companies to handle foreign exchange risk. Additionally, condensed financial flows influence states that depend on foreign capital to maintain credit and economic doings.[41] Savings are eroded by low interest rates imposed by policymakers to stimulate demand and safeguard bank balance sheets, by diminishing asset prices, or by crisis response measures such as forcing transfers at critical rates.

It has to be taken into consideration that management translates the corporation's investment in inventories and receivables into cash as swiftly as possible.

Nevertheless, as a corporation raises profits, it takes bigger risks, necessitating thorough cash management. In other words, as a company becomes more competitive, there is a cost in terms of higher inventories, more competent production equipment, and more liberal credit policies to inspire sales. In addition, competitive strategies augment the corporation's necessity for cash flow by slowing down the speed at which working capital is transformed into cash and by intensifying the volume of resources tied up in each of the working capital components. It has to be taken into account that credit derivatives are used in the diversification and transfer of credit risk, the capacity to leverage, and the formation of new asset classes offering yield enhancement. To that extent, a default swap is a bilateral contract permitting an investor to buy protection against the risk of default of a specified reference credit. Also, a spread option is a contract whose payout rests on the credit spread of a reference asset.[42]

Taking into account that risk tolerance is the degree of uncertainty that a trader is willing to undergo, which is influenced by elements such as financial objectives and experience in the market, one's risk tolerance shapes a trading plan that aligns with personal preferences. To that extent, "risk tolerance" affects the trading decisions of a trader and the degree of risk that a trader takes in shaping the choice of position size and stop-loss level. It is worth noting that the interaction between risk tolerance and capital protection forms a basis for trading strategies. In line with this, Pravin Kumar Srivastava[43] argues that "By setting a clear-cut stop loss, traders mitigate the impact of adverse market movements, preserving capital and preventing sizable drawdowns. This proactive risk management approach is essential for maintaining financial stability and resilience in the face of market uncertainties."

Cyber risk poses a significant strategic challenge to leaders across industries in taking advantage of the technological advances in networked technology**.** Given the rising risk and expense of cyber breaches, a corporation must employ effective cyber risk governance, ensuring that cyber risks are managed across a corporation.[44] It has to be taken into account that the cyber risk management program has to deal with key risks in a cost-effective way, permitting corporations to become cyber resilient.

It has to be taken into consideration that portfolio allocation plays a central part in investment management by reaching an optimal balance between risk and return within a diversified range of assets via "mean-variance optimization," ascertaining the optimal asset weights that maximize expected return for a given level of risk. Regarding Deep Reinforcement Learning models, Eric Benhamou et al.[45] argue that "Incorporating adaptive and flexible strategies in these models can revolutionize traditional portfolio management, advancing risk-adjusted performance and optimization techniques…formulating traditional financial techniques as reinforcement learning problems can enhance portfolio allocation decisions."

Investors consider the risks interconnected with investment by investing in securities[46] when they seek the best returns possible compared with the risks they take. Hence, investors and market participants require means, methods, and models to support them in selecting the most favorable portfolio, taking into account the advancement and growth of markets and instruments for finance, the complexity of

financial markets, as well as the area of investment. Also, the market risk premium and value elements explain the changes in excess return both on daily and monthly intervals.[47]

In the end, it is worth noting that conditional performance evaluation assesses the investment performance of portfolio managers, adjusting for the risks and other features of their portfolios and thus finding those managers who have investment information or skills superior to that of the investing public, and who use the advantage to achieve superior portfolio returns. The cash flow earnings are vital to the financial performance of the corporation, and so, the cash flow is used for stock buybacks, new investments, dividends, and debt repayment which means that the cash flow earnings statement and the traditional profit and loss statement are like mirror images.[48]

3.6 AI and Risk Management

3.6.1 Outlining Risk

Risk refers to variation in corporate outcomes or performance that cannot be predicted ex ante. Risk encompasses factors either external or internal to the company that influence the risk experienced by the company and thus refers to a foundation of risk. Examples of risk include "political risk" and the “competitive risk” associated with volatility in company performance due to particular uncertain environmental variables. Hence, risk is the net negative influence of the exercise of vulnerability regarding both the prospect and the effect of occurrence. Risk management is the process of identifying risk, assessing risk, and taking steps to mitigate risk to a tolerable point.

In the digitalization era, there is a need to control emerging risks to facilitate predictive risk management, which means that corporations must integrate artificial intelligence into their risk management strategies in order to handle new challenges. To that extent, P. B. Mokoena and K. Guesmi[49] argue that

> “Emerging risks, characterized by their potential for significant impact and inherent uncertainty, are becoming increasingly apparent under novel or unfamiliar conditions. The effective management of these risks is pivotal for organizational survival in the face of technological advancements and disruptors. Predictive intelligence, through its ability to discern patterns and interpret early warning signals, emerges as a critical tool for businesses to adapt and maintain emergency preparedness and risk resilience.”

Is it possible to eliminate risk? The answer is no, but a well-organized risk management lowers the degree of uncertainty about the predicted and final outcome concerning any project. There are two characteristics and equally central types of risk in a strategic alliance: first, relational risk, and second, performance risk. Relational risk is related to cooperative relationships or the prospect that the partner does not fulfill the spirit of cooperation.[50] Performance risk is the prospect that the strategic objective of an alliance may not be accomplished, given that the best

likely cooperation survives between the associates. Though performance risk is not related to cooperation, forging strategic alliances alleviates the scale of performance risk faced by particular companies. Without a doubt, risk-sharing is a central justification for having an alliance. The notion of risk as performance variance is broadly employed in finance, strategic management, and economics.

Risk-sharing or risk controlling is a central justification for joining strategic alliances.[51] A successful strategic alliance depends significantly on effective cooperation between the partners, since the motive for entering into an alliance is to utilize the benefits of cooperation. Strategic alliances have emerged in recent years as a popular strategy in an environment in which rapid access to up-to-date expertise and emerging markets is more vital than ever.[52] Moreover, strategic alliances are regarded as a form of cooperative arrangement between corporations. Clearly, corporations try to obtain maximum returns from the resources they commit to the alliances while paying close attention to the risks they are exposed to.

Credit risk arises from the perspective that one participant in a financial instrument is triggering a financial loss for the other participant by neglecting to discharge an obligation.[53] On the other hand, losses result from a decline in portfolio value as a result of real or alleged deterioration in credit quality. Moreover, credit risk stems from a bank's dealings with individuals, corporations, financial institutions, or a state. Market risk is the risk of losses in on- and off-balance-sheet status arising from engagements in market prices. Various risks related to market and price fluctuations include those pertaining to interest rate-related instruments and equities[54] which means that foreign exchange risk and product risk transpire throughout the banks' activities. General market risk is the potential for trading losses due to general market movements. Furthermore, specific market risk is the potential for losses incurred over the short term as a result of issuer-specific issues.

Private credit strategies incorporate direct lending, venture debt, real estate debt, infrastructure debt, etc. Moreover, private credit funds are competing with conventional finance providers, such as commercial banks, in a global market full of large-scale risks. In addition, the reliance of private credit funds on private bargaining enhances economic efficiency. Also, the advancement of digital lending and FinTech lending, along with competition among commercial banks and non-traditional finance providers, is shaping the global debt financing markets.[55] On the other hand, the increasing prospect of debt influences corporations' performance.[56] In line, N Lalafaryan[57] argues that "outside financial distress, often debt and equity simply can no longer exist in a vacuum from one another. The reliance of private credit funds on private (contractual) bargaining can also improve the economic efficiency." Moreover, the advancement of new AI finance funds run by AI technology and AAI humanoids will generate new finance modeling.

Operational risk emerges on account of inadequate management, being referred to as the risk of corporate governance exposure. The breadth of operational risk is diverse, encompassing numerous grounds dealing primarily with extreme events rather than crucial estimates or tendencies that dazzle with abnormal rather than normal conduct and situations. Furthermore, operational risk involves a diverse nature of events escalating from internal or external disruptions to business activities and

the irregularity of financial influence.[58] Managers of alternative investment funds establish a past loss record for the accumulation of operational risk, verifying quantitative and qualitative risk constraints for each alternative investment fund they administer, including market, credit,[59] liquidity, counterparty, and operational risks, and estimating investment performance by means of both the "gross" and the "commitment method."

It could be said that advances in robotics have dramatically simplified the interface between digital systems and physical tasks. Hence, technologies bring the physical and digital economies together, augmenting commercial and social value better than before. Thus, amplified intelligence and automation drive productivity while noticeably reducing risks.[60]

The EU Artificial Intelligence Act (AIA) describes four risk categories: unacceptable, high, limited, and minimal. Nonetheless, as these categories are grounded in broad fields of application of AI, the risk magnitude may be incorrectly assessed, and the AIA may not be enforced successfully.[61] The EU strategy on AI may be compromised, hindering innovation and sacrificing AI's prospective advantages for the values the AIA defends. Consequently, it seems that the AIA necessitates a clear model of risk assessment.[62] It is argued that the AIA predetermines the outcome of the balancing test between the values and interests of the affected community, with no choice for revision of risk management actions based on further circumstances, thus generating an erroneous evaluation of the risk magnitude of AI, encompassing the possibility of detriment and severity of outcomes leading to ineffective legal rules, whether too strict or lenient.[63] It could be argued that there is a kind of formalism in regulating AI applications, which means that the rules must be formalized and standardized in order to be applicable via AI systems, offering legal certainty on digital finance and financial crimes and thus permitting digital competition. To that extent, Sandra Wachter[64] argues that

> "the strong lobbying efforts of big tech companies and member states were unfortunately able to water down much of the AIA. An overreliance on self-regulation, self-certification, weak oversight and investigatory mechanisms, and far-reaching exceptions for both the public and private sectors are the product of this lobbying."

3.6.2 Risk Management

Managing risk is one of the key objectives of corporations operating globally.[65] The notion of risk as performance difference is broadly employed in finance, economics, and strategic management. With either the variance or negative variation comprehension, "risk" refers to a modification in corporate results or performance that cannot be calculated ex ante. Moreover, "risk" has been delegated to features that are either external or internal to a corporation and influence the risk faced by a corporation. In this sense, "risk" in reality applies to a source of risk.

Risk measurement is the classification and analysis of both quantitative and qualitative risks to the accomplishment of business objectives, producing a foundation

for shaping how risks should be managed, which means that risk management[66] produces value. It is characteristic that even though risk management is the quality control of finance to ensure the efficient performance of the business approach, risk management involves risk measurement, risk reporting, risk monitoring, and risk management in a narrow sense. Hence, risk measurement is activated by categorizing all the sources of risks and the terms of the display of the likelihood distribution. In other words, these sources of risk are cataloged as market risk, credit risk, liquidity risk, legal risk, operational risk, and business risks.

In fact, operational risks involve matters from ineffective practices and inadequate internal controls to technological weaknesses, which means that by improving internal controls, boosting process effectiveness, and endorsing robust cybersecurity measures, the management of these risks is achieved. Hence, operational risks are diminished by utilizing FinTech and facilitating access to credit, reducing the costs of credit and other financial transactions. Furthermore, FinTech expands financial inclusion by advancing services to businesses and individuals that are otherwise excluded as a result of the limitations of their business structures, shortage of access to banking or acceptable collateral, which means requiring cross-border payments and remittance transfer systems. Crypto-assets could act as an antidote to financial exclusion.

As a general rule, a real risk is an amalgamation of the possibility or occurrence of an incident and its consequences, which are usually negative, measured by the unpredictability of results. Uncertainty is less defined because the possibility of an uncertain event is unidentified, as is its effect. Economists differentiate between risk and uncertainty. Regarding risk, it is understood that the possibilities of future loss are identified, while possibilities are not identified concerning uncertainties.[67] Besides, the term "uncertainty," as used in strategic management and organization theory, refers to the unpredictability of environmental or organizational factors that influence corporate operation[68] or the lack of information about these factors.[69] Moreover, uncertainty arises from exogenous shocks, unforeseeable behavioral choices, or a mixture of the two.

Is risk management merely risk mitigation? It could be argued that risk management is not risk mitigation. Risk management means embracing, firstly, selecting to abstain from certain risky business activities; secondly, compelling deterrents and quick response control procedures with the purpose of mitigating operational risk; thirdly, recognizing that certain risks are needed to generate the suitable amount of return; and fourthly, relocating risk to third parties through hedging and insurance.[70] It is considered that operational risk is "the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events, and includes legal risk."[71]

Risk management includes three processes: risk assessment, risk mitigation, and evaluation and assessment, allowing IT managers to assess the operational and economic costs of defensive actions and, consequently, accomplish gains in mission capability by protecting the IT systems and data that assist a corporation's tasks. Risk management augments value when it facilitates states of the world in

which a corporation has inadequate internal funds to invest in positive-net-present-value chances.[72]

It is worth noting here that capital protection is the fundamental objective of risk management, and so, conserving capital is not only about evading substantial losses but also about safeguarding that a trader is participating in the market. Moreover, a well-considered risk management strategy, embracing adapted stop losses, functions as a defense against the shock of large drawdowns on a trader's overall portfolio. Hence, the interaction between risk tolerance and capital protection is central to successful trading. Thus, molding stop-loss levels and overall risk management strategies to personal preferences is not simply a choice but an obligation for traders looking for success in the market, which means that thoughtless and precarious decisions do not strengthen a trader's spirit in tackling the ever-changing landscape of financial markets.

3.6.3 Tax Risk

It is worth noting that financial tax risks capture uncertainties in anticipated future cash flows stemming from corporate tax planning, which means that companies can diminish tax risk through the installation of an efficient internal information setting.[73] In other words, information utilization is the means of managing tax risk. Moreover, internal control mechanisms aid in spotting tax planning inefficiencies and, consequently, contribute to higher tax outcome sustainability. To that extent, A. I. Brühne and D. Schanz[74] argue that

> "in the tax context, firms rely on communication to manage tax risks proactively. Based on our insights, we find that tax communication used for corporate tax risk management is addressee-specific and depends on the pressure types: public pressure, peer pressure, and regulatory pressure."

It has to be taken into consideration that tax planning investments and the output of anticipated tax savings are positively linked since rationally acting corporations only conduct profitable investments. Advani et al.[75] reveal that a significant part of all observed tax reporting violations is attributed to unintentional errors as a result of the complexity of tax law, and the positive long-term effects of tax audits mostly come from correcting errors made by taxpayers. Kay Blaufus[76] et al.

> "show a positive relationship between the quality of the tax control framework and the need for comprehensive improvements in human capital and internal processes, suggesting that the tax control framework affects the firms' perceptions of their tax capabilities and drives organizational changes."

It is worth noting that effective taxation is vital for the economic functioning of a state and the achievement of goals in the public interest, including the Sustainable Development Goals (SDGs). Moreover, tax justice seeks to achieve equality and social justice via fair and equitable tax structures; thus, a tax system must be progressive by redistributing income in an inclusive manner, lifting revenues to fund

public services, and tackling tax competition and tax incentives, which means prohibiting unlawful financial drifts such as tax evasion and avoidance.[77]

Tax audits compel additional administrative costs along with direct costs in the form of underpaid taxes and penalties through audit adjustments on corporations.[78] Companies differ considerably in their quality of tax control and, thus, large differences in tax risk arise since companies with a lower level of tax control quality are prone to compliance errors, which might also add to the observed cross-sectional variation in the companies' effective tax rates.[79] Also, an upsurge in audit aggressiveness alters the costs of compliance errors such that companies adjust the quality of their tax control agenda to diminish future errors.

Will the taxation of AI systems replace the taxation of workers? Since AI systems gain legal personality and, as a result, accumulating wealth means that they have to be taxed as well. Hence, the taxation of robots tackles the reduced tax base and displacement of workers projected as a result of automation. In other words, the taxation of AI systems will follow rather than justify granting them personality.

3.6.4 Supply Chain Risk Management

Manufacturing supply chains are influenced by supply chain risk (SCR), embracing any prospective negative outcomes directly or indirectly affecting the competence of a supply chain to manage supply and demand. To that extent, supply chain risk management (SCRM) refers to managing supply chain risks due to the flexibility of business strategies regarding supply, process, and demand, and its function in forming the flexibility of the supply chain. It is characteristic that vertical integrations, accompanied by shorter lifecycles of products, upset the weaknesses of current supply networks. It must be taken into consideration that a critical feature of SCRM is its emphasis on the supply chain level, rather than addressing risks at a corporate level. Additionally, SCRM deals with governing prospective supply chain risks.

The supply chain risk embraces any troubles in the upstream, downstream, or internal environment of a supply chain, triggering negative results in the competence of the supply chain to coordinate supply and demand. Moreover, risk and uncertainty in supply chains are interconnected terms, where risk has mostly negative consequences and uncertainty can have both positive and negative consequences. Additionally, supply chain uncertainties generate weaknesses, of which the quantifiable uncertainties are scrutinized and dealt with by supply chain risk management.[80]

Electronics manufacturing corporations functioning in a global environment are subject to risks, and resilience is a vital part of accomplishing sustainable competitive advantages. Moreover, flexibility, being an ingredient of resilience, must be built into the upstream, downstream, and internal supply chain settings in order to gain resilience.[81] Hence, electronic supply chains operate in global settings and markets, which means flexibility is needed for any supply chains performing under such conditions; therefore, supply chain flexibility and resilience are crucial to the management of electronics manufacturing supply chains. It could be said that

supply chain resilience augments the choice and implementation of appropriate risk management strategies.

Manufacturing corporations and their supply chains for electronic products are managed through flexible business strategies concerning their supply chains by diminishing complexities and augmenting network flexibility. It is worth noting that the strategic relations to various categories of flexibility, such as product, process, and production flexibility, in conjunction with supply and demand flexibility offered by networks, are of decisive significance in the SCRM agenda. In other words, flexible business strategies enhance supply chain strength by eliminating any extra complexities. It must be taken into consideration that flexible corporate strategies for handling demand, supply, and managing risks boost the success of risk mitigation practices.

3.7 Financial Risk Management and AI

Globalization and deregulation have amplified market volatility, risks, and uncertainties, which means possibilities for inefficiency. There is a need to reduce volatility as a measure of the extent of risk management. Companies hedge some risks so that they can take on more of other risks. A significant measure of risk management is the prospect that a company will become financially troubled or will find itself in a financial situation that is worse than the one that would permit a company to follow its whole strategy.

Global firms face a new truth that has altered the character of risk and risk management through networked ventures and global value chains, empowered stakeholders, and the energetic strain among divisions. The novel environment involves innovation by firms in both sensing and understanding these risks, and in adapting risk management systems to embrace innovative tools and network-based models of information sharing.

Financial risk refers to opportunistic activities correlated to future risks that may engender positive or negative consequences.[82] Moreover, longer-term alterations to global financial infrastructure are challenging if they diminish welfare benefits from the current system's expansive network effects, economies of scale, and scope. Hence, the global financial infrastructure is primarily built on shared confidence, largely about the strength of legal constructs and institutions. Lev E. Breydo[83] points out that "the broader portfolio of sanctions—of which sovereign debt provisions are just one facets—reflects a response to an 'unlawful,' full-scale war strongly condemned by the United Nations, rather than bilateral animus." In other words, it seems that politics blur the applicability of international law.

Many private-sector corporations engage in risk management, especially in the financial services industry, such as investment banking, commercial banking, and insurance. Both interest and capacity in risk management are mounting swiftly.[84] The rapid development of interest and capacity in risk management is driven by several variables, such as the growth in financial derivative markets and products, and the stimulating competence for risk management that they provide.[85] Effective

volatility forecasts enhance financial risk management by holding prospective complicated nonlinear portfolios at different horizons.

A corporation's strategy deals with the position of the organization in its uncertain environment. Risk management is not restricted to the appraisal of exposure to losses and the request for suitable financial risk management procedures such as insurance and hedging instruments. Financial and strategic responses are interconnected, and in preparing risk management responses when dealing with exposure to uncertainties, corporate management develops its range of probable responses by deliberating both financial and strategic replies. Nonetheless, uncertainty management encompasses more than the amalgamation of risk management and opportunity management. Uncertainty management is not just about managing apparent threats, opportunities, and their implications; it means that uncertainty management is about distinguishing and managing all causes of uncertainty that produce and mold perceptions of threats and opportunities, investigating and understanding the genesis of venture uncertainty prior to managing it, with no presumptions about what is advantageous or detrimental.[86]

The management of financial corporations has a sequence of specificities that influence their governance, resulting in the adaptation of general rules of corporate governance to account for their diverse features.[87] Financial systems add to economic development by providing individuals with constructive tools for risk management, but when they not succeed to manage the risks, they tend to create critical financial crises with overwhelming social and economic effects. While efforts to reinforce financial systems and enhance the flexibility of the global financial system continue around the globe, the challenge for policymakers is to integrate the lessons from the breakdown to consider the multifaceted relationship between financial, fiscal, real, and social risks and ensure efficient risk management at all levels of society.[88] It is worth noting here that the prevailing corporate governance ecosystem relies on private players to develop governance changes, not to mention the impact of current AI technology on corporate governance, while forthcoming AAI systems will govern AI corporations utilizing the best governance schemes generated by the expanded datafication driven by AAI humanoids.

Risk management is not restricted to the evaluation of exposure to losses and the application of suitable financial risk management practices such as insurance and hedging instruments; it also ensures that financial risk management practices diminish corporate exposure to specific risks without altering the corporation's strategy. Strategic responses influence a corporation's exposure across a range of environmental uncertainties. Hence, financial risk management and transformations in corporate strategy are two tactics to control exposure to environmental uncertainties. Financial risk management methods diminish corporate exposures to specific risks without altering a corporation's strategy, and so there is a need for strategic responses to uncertainties.

Risk management is a field at the center of every financial institution, covering all the actions that influence its risk profile. Hence, risk management involves the identification, assessment, monitoring, and controlling of risks to ensure that the individuals who take or manage risks clearly comprehend them. In fact, financial

risk management involves detecting, analyzing, and delivering strategies in order to reduce damages regarding financial stability. Moreover, financial risk management involves key financial risk-reduction methods such as acquiring insurance and buying and selling financial instruments like forward contracts, futures contracts, swaps, and options. Additionally, financial hedging instruments are broadly used by companies to handle foreign exchange risk. Risk management[89] is not central to the success of a hedge fund, and regulatory constraints and compliance issues are matters of performance, which means that the whole point of a hedge fund is to avoid these issues. Hence, risk management and risk transparency are crucial. It must be taken into account that risk management produces value by decreasing the variability of corporate value or cash flows.

Financial systems add to economic expansion by providing individuals with useful means for risk management, such as credit for productive investments, means for saving and insurance, and payment services. Simultaneously, when financial institutions fail to manage the risks they hold, they generate severe financial crises with shocking social and economic outcomes, particularly for the world's most vulnerable individuals. To that extent, the principal objective of the UNCITRAL Model Law[90] is to promote low-cost credit by improving the availability of secured credit. Moreover, the UNCITRAL Model Law establishes clear rules allowing access to low-cost credit in cross-border assignments and loan transactions, thereby promoting the establishment of the Registry system.[91]

The notions of effective markets and diversification are the two pillars of modern finance theory. Market competence purely states that markets don't leave money on the table and information is incorporated into prices, so that one cannot make profits from it. Risk management is coupled with the utilization of market insurance to safeguard individuals and firms from various losses related with disasters.[92] Financial institutions established internal risk management schemes and capital calculation methods to safeguard themselves from unexpected risks and diminish regulatory capital.

Credit risk is intrinsic to the business of lending funds to ventures related directly to market risk variables. The purpose of credit risk management is to diminish the risk and amplify the bank's risk-adjusted rate of return by taking on and upholding credit exposure within the satisfactory boundary. Unobservable imperfections and information asymmetry are variables in the risk management equation. On the one hand, credit risk encompasses employing quantitative methods and financial models to evaluate the prospective risk of financial losses occurring from the default or non-performance of a counterparty in financial transactions. On the other hand, counterparty credit risk concerns the impending risk that a counterparty, by defaulting on its financial responsibilities, leads to financial losses for the other party. To that extent, Stulz[93] argues that corporations will manage risk to reduce cash flow volatility because it diminishes one of the costs interconnected to managerial discretion in the occurrence of information asymmetry about managerial actions. Moreover, DeMarzo and Duffie prove that a risk management strategy is advantageous for shareholders confronted with information asymmetry about the dividend stream.[94]

Financial crises deteriorate economic endeavors, diminishing consumption and investment demand, resulting in continual weakening of economic expansion, loss of jobs, cuts in wages and benefits, and higher unemployment or employment involving fewer hours and lower benefits. Furthermore, financial crises are classically followed by diminished financial flows across states in the form of foreign capital and remittances, erosion of savings, and reduced accessibility and/or higher costs of credit.

A company should manage risks so that the market value of its equity is adequate to make bankruptcy unlikely. It could be said that increases in equity capital are a direct substitute for risk management. Thus, through risk management, corporations save equity capital, achieving more leverage than otherwise. Equity is the current value of future cash flows to equity, and so one should be concerned about the factors that influence the current value of future cash flows. On the other hand, current practice of risk management[95] is concerned about hedging transaction risk or the risk of transactions anticipated to take place in the short run.

It is characteristic that risk management is linked to valuation. In the process of discovering the causes that influence the value of a company, one learns the features that are accountable for changes in the value of a corporation. In efficient markets, corporations do not make money by taking financial positions based on information that is publicly available. Hence, corporations should avoid financial positions that lead them to be financially distressed and powerless to execute their overall strategy. Nevertheless, corporations gather information that is not publicly available, granting them a relative advantage in taking certain kinds of risks over their shareholders. It must be taken into account that, based on the secured information, a determination of risk made by the corporation is grounded in its own policies and risk appetite, dictating what "effective action" must be taken to diminish their money laundering, terrorist financing, and proliferation financing risks.

It has to be taken into account that tax rates differ depending on the taxable income, which means that a company would like more income when its tax rate is low and less income when its tax rate is high. Since tax rates escalate with taxable income, a risk management program diminishing the risk of taxable income ends up lessening estimated taxes as well. While shareholders can diversify risks, stakeholders who have a large stake in the success of the corporation cannot classically do so.

Risk management is coupled with the utilization of market insurance to safeguard individuals and corporations from various losses related to disasters.[96] Financial institutions established internal risk management schemes and capital calculation methods to safeguard themselves from unexpected risks and diminish regulatory capital. Simultaneously, governance of risk management developed into a necessity; integrated risk management was initiated, and the chief risk officer (CRO) position was formed. Risk management decisions are now financial assessments that must be estimated based on their impact on corporate or portfolio value, rather than on how well they address specific risks. Furthermore, risk management is a key topic for corporations in a global economy, not to mention the demand for AI risk management in light of the growing AI economy. Unnecessary risk-taking

to enhance financial company stock prices played a significant role in the 2007 financial and economic crisis. To that extent, Burner[97] indicated that a decline in genuine risk-free rates of interest to historically low levels led to credit expansion in a vicious search for profit among investors. According to Lang and Jagtiani[98] one of the reasons for the financial crisis was that large financial corporations were eager to take on complex mortgage-related products when they had not generated the competence to evaluate the portfolio risk of these activities. Hence, financial corporations lacked robust internal controls, accurate and timely financial and risk reporting to the appropriate management level, and a company-wide view of risk or a company-wide risk management program.

A corporation preparing a risk management map needs three vital steps: the identification of risk, assessing risk, and developing strategies to manage and diminish its influence on the process. In addition, the corporation's chart has to identify the strategy for dealing with risks specific to the industry. If the firm simplifies prospective risks, it creates the most appropriate management plan for that specific matter. The risk management practice must be adjusted toward the prioritization of risks, emphasizing those that are most relevant to turn into the focus of enhanced control.

AI technology has altered the essence of risk management implementation by offering more accurate, updated data, data-driven, and adaptive techniques. AI has progressed from plain automation to complex systems adjusting to various risk conditions, which means that AI advancements encompassing machine learning, deep learning, natural language processing, and robotics accelerate new means of managing risks. Furthermore, AI advances enhance productivity and, in parallel, address new challenges stemming from a swiftly transforming financial environment. Thus, with greater response times and more future forecasting, AI systems are tools with which threats are minimized. Moreover, forthcoming AAI systems will automatically adjust the controlling devices in the nature of the emerging risk in order to avoid damages by modifying management movements.

AI risk management allows corporations to share knowledge and insights without definitively compromising private information. Thus, corporations and financial institutions can employ common risk models together while keeping proprietary data private and secure. Bohan Li[99] indicates that

> "In financial risk management, AI has grown to be a disruptor, providing new solutions for formerly nagging problems. Its applications in predictive analytics, fraud detection, automating decision making processes, and portfolio optimization have made risk management more precise, effective, and agile…opportunities in everything from data analysis to developing AI and financial advising."

Digital payments and online banking allow fraud to be executed quickly and anonymously, which means that financial fraud entails the use of deceit to gain monetary benefits. Moreover, fraud has been digitized, automated, and globally coordinated. Taking into account the global and borderless nature of cryptocurrency transactions,

exchanges have to endorse advanced fraud risk management strategies in order to ensure security and regulatory compliance.

3.8 Risk Management Implications and Finance

Risk management is a key topic in operations management, and so, the financial development of cyberspace supply chain accelerates the modification of enterprise financing modes. Supply chain operations have entered the digital era with the emergence of blockchain technology. At present, supply chain finance is combined with cyberspace, improving the information asymmetry of both parties through network function benefits, and so, it aids the decision-making department in advancing the financing problems of companies. Additionally, with the emergence and rapid development of e-commerce, the logistics industry gradually rises. Furthermore, there are risks in cyberspace supply chain finance; with the rapid development of cyberspace, new technologies have not been fully tested in practice, and hackers, network fraud, and other problems have surfaced. When supply chain finance enters the cyberspace setting, there are software vulnerabilities, and if the repairs are not timely, there will be significant losses, which means that there may be information fraud, information leakage, capital loss, and other issues. To that extent, cyberspace supply chain finance has the qualities of vertical industry orientation, specialization, vulnerability, and instability.

As mentioned earlier, credit risk management has evolved immensely in recent decades. Due to advances in information technology, the monitoring of credit risk has improved, which means that, owing to financial innovations, risk-sharing has become easier to access. Some basic level of risk management is imposed upon banks by financial regulation, and so, banks choose whether to gather additional information on credit risk and whether to share credit risk.

It is characteristic that competition pushes banks to implement advanced risk management practices. Sector concentration in the loan market promotes credit portfolio modeling, but it inhibits credit risk transfer. Furthermore, by implementing a credit portfolio model, banks detect the correlation within their loan portfolios, adjusting their buffers or capital structures to their portfolio structures. Additionally, banks participate in credit risk transfer by swapping half of their loan portfolio for the loan portfolio of another bank, which means that, via risk transfer, banks spread their portfolios.[100] AI in monetary risk management encompasses predictive analytics in facilitating an organization in rightly predefining credit risk and market trends via machine learning algorithms assessing data and modeling different situations to predict forthcoming threats and opportunities.

Financial institutions face a variety of risks in their portfolios due to AI utilization. Whether there are market and credit risks for investment portfolios, default and prepayment risk on their mortgage portfolios, or longevity risk on life insurance portfolios, the balance sheet of a bank or insurance firm is subject to many risk factors. Hence, failure to manage these risks leads to insolvency with the accompanying losses to shareholders, bondholders, and customers or overly conservative

business strategies that hurt consumers. To that extent, together with qualitative assessments, portfolio risk management demands quantitative models that are accurate and fast to offer useful information to management. Furthermore, government regulations, such as solvency regimes, involve extensive calculations to generate the needed reports.[101]

Is the structure of the financial system a key determinant of systemic risk? It is worth mentioning here that systemic risk is the risk that an incident activates a loss of economic value or confidence in a large part of the financial system, causing substantial adverse effects on the real economy. It has to be taken into account that shocks that hit part of the system, such as the subprime mortgage market in 2007, grow through a complex network of interconnections among financial and non-financial institutions, having a disastrous effect on the entire economy.[102] On the other hand, in the absence of this network, localized shocks hitting individual participants or certain parts of a financial system would not spread; thus, a network of interconnected players denotes multifaceted links among financial market participants and institutions, which is a characteristic of the modern global financial system.[103] Luca Enriques[104] at al. argue that

> "any deviation from corporate governance and corporate law core principles and rules with a view to curbing systemic risk is justified to the extent that the actions of the relevant players, that is, the managers, directors and shareholders of any given SIFI, affect systemic risk."

It has to be taken into consideration that borrowers with high liquidity risk are paying a markup to lock in their funding, independent of risk premiums demanded by lenders; however, borrowers are paying higher rates to lock in their funding if they are exposed to liquidity shocks. Funding liquidity risk is the risk of a liquidity shock leading to a binding funding constraint. Moreover, banks are funding illiquidity because maturity transformation is at the center of their business model, and so, funding liquidity risk materializes in the form of bank runs.[105] To that extent, the global financial crisis of 2007–2009 re-emphasized the significance of funding liquidity for financial stability, highlighting that bank runs take place in wholesale funding markets.[106]

Moreover, it has to be taken into account that the funding liquidity risk channel relates to the lending business of banks because liquidity shocks are either positive or negative. Henceforth, banks with high liquidity risk have a motivation to demand immediacy by accepting lower interest rates to evade having to resort to the central bank. Alexander Bechtel et al.[107] portray

> "the importance of sophisticated liquidity management for banks. Since it is costly to demand immediacy following liquidity shocks, banks must account for these additional costs in their business decision—for example, through liquidity transfer pricing. Quantifying the cost of funding immediacy enables banks understand the trade-off between larger liquidity buffers and the need to be more aggressive to obtain funding."

To that extent, it could be argued that internal procedures, such as liquidity transfer pricing and funding value alterations, generate a network through which inefficient liquidity management influences investment decisions, pricing, and loan extensions which means that banks pass-through the differences in funding costs to their clients, such that heterogeneity spreads outside funding markets.

It is worth noting that both corporations and investors have become too short-term oriented in their investment horizon, leading to decisions that surge near-term reported profits at the expense of the long-term sustainability of those profits being externalities, borne by members of the workforce or society at large.[108] Boards advance their analysis of ESG (environmental, social, governance) risks and opportunities at a practical level by bearing in mind how long-term investors integrate ESG factors into their decision-making procedure.[109] It must be taken into consideration that there has been a shift in power from managers to shareholders, which is a move denoting the objective of market control of the corporation.[110]

It has to be taken into account that sustainable finance plans have materialized globally as a set of restructurings affecting the management of the financial risks created for corporations by biodiversity loss. Thus, aligning private capital with global sustainability objectives addresses the broader systemic risks caused by climate change, etc. Additionally, the EU's sustainable finance package[111] epitomizes the first sustainable finance agendas around the globe; therefore, the EU reform package encompasses mandatory corporate sustainability reporting,[112] mandatory corporate transition planning,[113] a sustainable finance taxonomy,[114] and financial product labeling rules.[115] Also, sustainable finance necessitates extra-financial factors embracing public health, social inequalities, and climate risk. As a result, the need for sustainable investing has largely been expressed in the incorporation of environmental, social, and governance (ESG) factors into corporate bond pricing, which means that participants consider their duty to integrate ESG factors into their financial decisions. To that extent, Anne Spencer Jamison et al.[116] claim that

> "ESG components, including natural and human capital, are critical inputs for long-term growth. The erosion of any component will generate long-term fiscal strain. Our contribution is primarily empirical, demonstrating that daily data on ESG factors as machine coded from media events influences sovereign bond risk."

It could be said that, in an AI environment, sustainable investment has moved from a niche business to a part of mainstream finance, and so, the financial community has concentrated on analyzing extra-financial features because ESG issues should be integrated within financial analysis, which means that environmental, social, and governance considerations are interconnected in long-term financial outcomes.

Do corporations function apart from markets or do they function within markets and under market control? It seems that there is a view of market control based on two assumptions: first, shareholders have the right reasons to lessen the managerial agency problem, and second, competitive markets are superior to institutions as controllers of production, and so shareholders are taking control.

To that extent, the rise of hedge funds and other activist investors has produced a swing in power from managers to shareholders, who are now empowered to make business decisions at publicly traded corporations. On the other hand, there is a position of questioning the shareholder-centric view of the corporation, defending an alternative "team production model" that accounts for the role of other stakeholders in the corporate organization, indicating the inadequacies of unrestricted shareholder power.[117]

What is the importance of sophisticated liquidity management for banks? Due to liquidity shocks, banks take into account these additional costs in their business decision via liquidity transfer pricing and so by quantifying the cost of funding banks trade-off between larger liquidity buffers and the necessity to be more aggressive to acquire funding. To that extent, it could be said that internal procedures, such as liquidity transfer pricing and funding value alterations, create a network through which inefficient liquidity management affects investment decisions, pricing, and loan extensions and so banks pass-through the differences in funding costs to their clients, such that heterogeneity spreads outside funding markets.

Markets disperse information about offered goods and services along with the buyers and sellers present in the market and thus function as price-generating mechanisms for the goods and services offered. Consequently, markets decide which goods are produced and at what prices they can be sold, which means that competitive markets allocate goods to those buyers who value them most.

It is worth noting that the instability of the financial sector during the Great Recession has left many questions unanswered concerning the risk management practices and hedging strategies of financial corporations, and so regulators have passed regulations across geographies and different parts of the financial sector. If there are no costs in raising external finance, then discrepancies in regulation do not affect the risk management decisions of financial companies. Nevertheless, if raising capital is costly, hedging choices are distorted, and so it is difficult to measure whether regulation is unreliable and distorts hedging decisions without knowing what optimal regulation is. Thus, it is not assessed how financial institutions respond to discrepancies in regulation and how hedging decisions are affected. Moreover, differences in the regulatory treatment of different products drive heterogeneity in hedging behavior across financial institutions in a large way.

It seems that the regulatory value of assets and liabilities does not alter from one valuation date to the next, even though the economic value changes with fluctuations in the equity market or the yield curve.[118] Besides, the value of derivatives is sensitive to interest rate and equity market movements under the regulatory framework, and so, insurance corporations have a reason not to hedge with derivatives because hedging the volatility in market values leads to volatility in regulatory capital, as only derivatives are sensitive, while the rest of the regulatory balance sheet is largely insensitive.

Ishita Sen[119] argues that

> "derivatives reduce the volatility of capital and surplus for the average insurer exposed to RS guarantees by close to 26% between 2010 and 2016.

> In contrast, there is no discernible reduction for insurers that underwrite PRS guarantees owing to the absence of interest rate hedging with derivatives. My estimates imply that had regulation shifted in a consistent manner, insurers exposed to PRS guarantees would have an additional combined exposure to interest rate derivatives equal to $23 billion in 2016. As PRS liabilities are highly concentrated, a large fraction of this shortfall in exposures is concentrated among the largest 10 insurers, amounting to about 22% of their capital and surplus."

It could be said that the regulatory framework interacts with monetary policy shifts and so, when interest rates are low, the "Stochastic" framework rules with a higher likelihood. Conversely, when interest rates rise, "Stochastic" liabilities fall even below Standard liabilities. Accordingly, when rates increase, there is a higher probability that the Standard framework will dominate.[120] Ishita Sen[121] shows that

> "the regulatory framework governing insurers in Europe (Solvency II) has important deviations from market values. Moreover, there are differences in risk sensitivities and how hedges are treated in model-based versus standardized frameworks within Basel III, which could affect the sensitivity of capital to market movements and may affect the hedging incentives of banks."

It is worth noting that the risk management distortions owing to the insensitivity of the regulatory framework arise for the reason that hedge derivatives are marked-to-market and so, hedging denotes a higher volatility of regulatory capital than not hedging, as gains or losses from derivatives do not offset losses or gains in regulatory liabilities due to their insensitivity generating an enticement to under-hedge true risk exposures, if insurers target the volatility of regulatory capital rather than the market value of capital. Thus, insurers care about the volatility of regulatory capital as regulators pay close attention to insurers' available capital relative to required capital, also known as the risk-based capital ratio (RBC). Furthermore, RBC is an imperative factor in an insurance company's credit rating affecting the future demand for insurance policies.[122]

It has to be taken into consideration that creditors are aware of the risk-adjusted returns on the credit that they extend because investors' objective is to create an anticipated gain surpassing the opportunity cost of capital. Also, while creditors possess a wide portfolio of debt instruments, spanning states and term lengths, they are restrained by both their short time horizons and their capacity to handle information.

It is characteristic that Non-Fungible Tokens (NFTs)[123] and DeFi assets add to optimal portfolio allocations surrounding success under distinctive portfolio construction techniques and are thus considered safe havens during financial and geopolitical turmoil.[124] Thus, there is a need to enrich risk management and portfolio optimization within the rapidly evolving NFT ecosystem through the utilization of AI systems.

It has to be taken into account that raising capital is costly, and so, insurers can adjust capital continuously to manage the volatility of regulatory capital.

Nonetheless, raising capital is costly, and capital market frictions affect the asset allocation and product market decisions of insurers. Moreover, it has to be taken into consideration that volatility forecasting is central to portfolio management, risk management, and pricing of financial derivatives. Specifically, the volatility of a financial asset is a main input to the optimal portfolio choice problem. Moreover, volatility forecasting is a mandatory risk management exercise for many financial institutions and banks around the globe, and so, volatility is the most important input variable in the valuation of derivative securities. To that extent, to price an option, one needs to identify the future volatility of the underlying asset until the option maturity. Hence, in portfolio management and risk management, the volatility must be forecasted over horizons ranging from 1 day to 1 month. Besides, in the valuation of derivative securities, the volatility must be forecasted over much longer horizons.

In line, on the CBOE one can trade short-term options with a maximum of 12 months to maturity and long-term options (LEAPS) that have expiration dates up to 39 months into the future. Moreover, Forward Volatility Agreements (FVA) contracts are traded in over-the-counter markets and have maturities ranging from 1 to 24 months[125] which means that the effective pricing of an option necessitates precise forecasting of volatility over a comparatively long-term period starting now. Therefore, the effective exploitation of an FVA contract compels accurate forecasting of volatility over a period starting at some distant point in the future.[126] Currently, there is a trade in derivatives that are written on volatility itself, such as Forward Volatility Agreements (FVA), which are forward contract on the future spot realized or implied volatility of a financial asset such as individual stock, stock market index, commodity, foreign currency, etc. Above all, the FVA specifies the realized or implied volatility for an interval starting at a future date. Thus, the worth of the FVA at maturity is the difference between the contractual volatility level, which is settled at the contract inception date, and the volatility level examined at the settlement date. To that extent, the strategic rationale to trade FVAs is that they permit investors to hedge volatility risk and to speculate on volatility levels. In line, Xingyi Li and Valeriy Zakamulin[127] argue that "First, our results significantly extend the horizon of volatility predictability reported in the earlier studies. Second, the horizon of volatility predictability is much shorter than the longest maturity of traded LEAPS (39 months) and FVA (24 months) contracts." Nonetheless, it seems that the horizon of volatility predictability is shorter than the longest maturity of traded derivative contracts.

An ICO is a new method to raise funds through the offer and sale by a group of developers or a company to a crowd of ad hoc crypto-assets specifically generated and issued on a distributed ledger, sometimes preceded by an early sale of the crypto-assets called "pre-sale," intending to launch a business or develop ad hoc governance of projects based on distributed ledger technology, classically in exchange for pre-existing "mainstream" crypto-assets, such as Bitcoin and Ether among others, or even fiat currencies.[128]

It is worth mentioning here that list of risks that AI produces are presented in the Artificial Intelligence Risk Management Framework ("AI RMF") intending

to boost trust in AI systems and illustrating the kinds of harm caused by AI.[129] AI instigates harm to people, such as infringing on civil liberties, endangering the psychological or physical safety of groups or individuals, or altering democratic participation. Moreover, AI triggers harm to organizations by obstructing business operations, enabling security breaches, or initiating harm to reputation. Finally, AI produces harm to the "ecosystem" by damaging interconnected means, disrupting the global financial system, or instigating environmental harm. In addition, AI RMF is correlated with the National Artificial Intelligence Initiative Act of 2020.[130]

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4 AI Formalism and Financial Competition

4.1 Introduction

AI is marked by autonomously generated inventions and is self-assembling, which means automating duties that normally require human intelligence. AI is applied to a variety of business models. AI technology extends human competencies. Additionally, AI inventions produced by AAI systems will generate virtual results transferable into the human world as well via AI tools. Hence, technological innovation is modifying private markets around the globe, and new developments in digital technology have caused new opportunities for subtle and evasive forms of anticompetitive behavior by private corporations.[1]

It is characteristic that the evolution of AI technologies has generated global connectivity, efficiency, and convenience; thus, in markets where there is fast technological transformation, even dominant companies are frightened by competitors' competencies, forcing them to repetitively buy and utilize tech devices and, on many occasions embracing anticompetitive practices that empower them to maintain their market advantage.

It has to be taken into account that countries have to become more competitive if they want to keep their economic position regarding other industrialized or developing countries and to react to encounters such as productivity growth, e-commerce, and technologies. Hence, competitiveness is grounded in the transformation of the economy into higher added value, productivity, and a more competent use of resources; thus, specialization is related to competitive advantages.[2] K. Khoo and A. Sng[3] argue that "Competition Policy exists to maximise economic welfare, thereby creating an 'economically efficient' state of affairs," but economic welfare has to be achieved via particular competition rules applied equally to all parties in a market because otherwise, economic welfare can encompass all methods of generating monopolies and oligopolies, resulting in harm to consumers in the end, as it is slowly happening with globalization. Also, Valdés[4] assumes that

> "free competition as a protected legal good seeks to harmonize the multitude of these freedoms of commercial competition existing in a civil society by way of limiting them to make them operational, and thus order them to the political common good."

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Corporations needing to remain competitive and progressive have to adjust due to global alterations by employing new management approaches, which means that rising international interaction, transformations in the technological space, rapid development of information technologies, and fluctuating consumer needs generate new challenges for corporations in a globalized world. Corporations have to align their personnel policies with broader strategic considerations, predominantly product market conditions and business strategy in a globally competitive environment.

It has to be taken into account that both antitrust and data privacy law affect corporations that keep and utilize personal data.[5] Technology corporations have used privacy as a shield in order to explain allegedly anticompetitive conduct in antitrust enforcement cases. In hiQ Labs, Inc. v. LinkedIn Corp.[6] HiQ challenged LinkedIn's privacy policy, alleging that LinkedIn denied it access to publicly available LinkedIn members' profiles, hindering hiQ from accumulating data to sell to its clients. In Epic Games, Inc. v. Apple, Inc.,[7] a technology company used privacy as a shield against antitrust liability involving allegations that Apple illegally monopolized app distribution and in-app payments on the iOS App Store. In Brunswick v. Pueblo Bowl-O-Mat, Inc.,[8] the Supreme Court stated that the purpose of antitrust laws is the protection of competition, not competitors. Justice Brandeis was a strong advocate of the democratic distribution of power and opportunity in the political economy, addressing how giant corporations' actions affect socioeconomic problems such as low wages and unemployment, pursuing to invalidate the established consumer welfare standard that is directed by price theory analysis.[9]

It is worth noting here that in platform ecosystems, interfirm conflict is restraining market power because the market controller can block the addition of new providers, which means that the adoption of emerging media technologies is postponed.[10] Hence, a company, by having restricted access to technologies, cannot design a similar and possibly better alternative to the one offered by a platform.[11]

It is obvious that there is a need to restore online competition. Also, competition between digital platforms increases the quality of privacy protection offered in the market. Moreover, it is argued that privacy is a factor of quality-based competition[12] but courts applying antitrust law cannot limit competition in the name of supporting other public policy interests such as public health, safety, or even privacy, in manners that are not specified by the legislation.[13] Thus, antitrust/competition law promotes competition[14] via formal legal competition rules identifying the particular economic elements grounding and advancing competition as such, not other public policy interests, even when those interests are undeniably lawful, which means that via competition all the other interests are promoted as well.

Innovations in ICT spark the transformation of society, consumer behavior, and workspace. Hence, digital transformation portrays the process of a corporation's prosperous adoption of digitalization. Moreover, the exposures of digitalized economies are tackled by corporations, and so the corporate digital responsibility (CDR) handles ethical problems initiated by digital transformation.[15] Moreover, CDR is a new management notion to undertake responsibility in the digital economy voluntarily by shifting management and production systems along with accepting the governance mode.[16] Digitization engrosses the automation of processes through the

use of information and communication technologies; therefore, corporations incorporate technological changes since the inability to embrace technological advancements leads to competitive failures.

The modern digital economy is built on a platform of exploitation of regulatory gaps and liability shields. Platforms like Uber[17] and Lyft and corporations like Amazon evade government regulation by manipulating legal and regulatory structures to externalize costs and increase profits. Hence, as the digital economy grows, high-tech corporations are prioritizing wealth maximization above all else at the expense of workers, third parties, and society as a whole.[18] Moreover, technology allows corporations to shift the risk and cost of excess labor or lost productivity to workers.[19] It is worth noting that some of the connections between platforms and providers can be considered as that of a franchisor/franchisee structure.[20]

There is a change from per se rules to a fact-sensitive methodology under the "rule of reason". While in Schwinn & Co,[21] the Supreme Court applied the per se standard, in GTE Sylvania, Inc,[22] the Supreme Court applied the rule of reason and so, rejecting the per se standard.[23] Moreover, while in the 50s, the Chicago school caused no impact, in the 80s, the Chicago school has prevailed regarding its viewpoint that antitrust problems must be assessed via price theory.[24] Zekos[25] illustrated the advancement of formalism in competition via the presentation of the economics-based rule of reason, the more economics-and-effects-based method indicating that the "per se rule" applied first in price-fixing cases.[26] The Supreme Court[27] pointed out that "categories of analysis of anticompetitive effect are less fixed than terms like 'per se,' 'quick look,' and 'rule of reason' tend to make them appear." Moreover, antitrust provisions against monopolization practices were not concerned with economic effects; rather, the statutory provisions contained in the Sherman Act were based upon the belief that "[…] great industrial consolidations are inherently undesirable, regardless of their economic results."[28] Additionally, the antitrust laws were passed for "the protection of *competition*, not *competitors*."[29] In fact, Zekos[30] has presented formalism denoting that the rule of law ideal is closely entangled with law's traditional tendency toward formalism, and the rule of law ideal asserts that no one should be above the law; even the highest officials are subject to legal constraints, which means that judicial formalists prefer to check formal adherence to rules rather than the motives and effects of the actions.

It has to be taken into consideration that Formalism offers a basis for "objectifying" legal concepts[31] and so, formalism generates strict definitional regimes in the form of cumulative necessary conditions for validity that, when satisfied and only when satisfied, meet the necessary condition of negotiability which is compatible with that of defining competition law and not competition in economic terms. In other words, "Formalistic" approach encompasses a comprehension of setting the needed and sufficient conditions of operating law in many spheres such as competition.

It has to be taken into account that AI technology can be utilized to specify which elements are the elements of achieving competitiveness. Especially, the use of AAI technology will allow the continuous examination of the changing elements that, at the specific time, are factors of higher competitiveness. In other words, AAI

technology by itself will investigate competitiveness, and in parallel it will automatically make the necessary advances in order to enhance competitiveness. Will AAI technology impose AI neo-formalism in competition?

4.2 Characteristics of Antitrust/Competition law

It has to be taken into account that there is no common competition law framework, and so, each country enforces its own competition laws, often with differing standards and procedures which means that a difficulty in enforcing antitrust policies has arisen, and so, inconsistencies in national regulations lead to unfair trade practices, monopolies, and market distortions generating anemic enforcement of competition laws and tolerating dominant corporations to engage in anticompetitive practices such as price-fixing and market monopolization.[32] Also, it could be said that competition law is considered to be embedded in neoclassical economics. Furthermore, antitrust legislation is rooted in neoclassical economics, which revolves around the principles of price theory.[33]

The antitrust laws were accepted against the economic concentration and the escalation of industrial trusts such as the railroad's control.[34] To that extent, competition has to be a device for diffusing economic power and dissolving power in the market sphere, which means that complete competition must be protected. Therefore, competition law-based judgments should create a unified internal market governed by the rules of free and undistorted competition. Thus, antitrust should concentrate on protecting and energizing competition, which is ultimately about economic outcomes achieved via a standardized competition process.

It has to be taken into account that antitrust laws aim to protect fair competition with the purpose of smoothing the playing field and lessening inequality. Moreover, fairness standards need clarity for daily business decisions, but competition forces corporations to tackle competencies, permitting them to advance the appeal of their products and services. It is deemed that unfair conduct is anticompetitive, and so, there is a need to standardize the elements denoting the context of fair, which means endorsing a formalistic approach that generates certainty about maintaining fair competition in the market. On the other hand, market competition is severe, upsetting corporations that fail to keep up with rivals, and so, economies of scale, along with the exploitation of network effects, give rise to large business corporations.

It has to be taken into account that the US antitrust laws do not levy restrictions on high prices or high profits, but they exclude transactions, agreements, and practices that harm or are likely to harm competition. Hence, antitrust law prohibits transactions, agreements, and practices that harm or are anticipated to damage competition. Moreover, antitrust law does not condemn the power to charge high prices when such competence is the outcome of greater product and business expertise. Therefore, the US Supreme Court has highlighted that, "as a general rule, businesses are free to choose the parties with whom they will deal, as well as the prices, terms, and conditions of that dealing,"[35] which means that the US antitrust laws have never prohibited high prices, regardless of their alleged unfairness.

Antitrust law and data privacy law are affecting the treatment of digital information.[36] Moreover, in the digital economy, data access can both drive competition and diminish privacy, due to the fact that breaching data privacy justifies anticompetitive conduct.[37] Also, it has to be taken into consideration that antitrust statutes speak plainly about economic perceptions such as monopolization, restraint of trade, and diminishing competition, thus embracing prohibitions on conduct. On the other hand, antitrust should focus on protecting and promoting competition, which ultimately concerns economic effects.[38] Judd Stone and Joshua D. Wright[39] say that "Antitrust's central goal, though, is not the preservation of the single-entity defense or Copperweld; instead, it is the maximization of consumer welfare through rules that account for error costs and administrative costs."

It is argued that US antitrust law has been branded by economic functionalism, and European antitrust law has been distinguished by legal formalism. In other words, US law approves economically grounded analysis instead of formalistic thinking.[40] On the other hand, EU law is transitioning from a highly bureaucratic system with formalistic rules and procedures to a more effects-based system in which economics plays a fundamental role in shaping competition policy and enforcement.[41] Furthermore, EU competition law has been characterized by legal formalism which means that the legality of certain business practices was determined on the basis of technical legal distinctions instead of their economic consequences.[42] Also, the European antitrust community has assumed that the Guidance Paper reflects a movement away from a "form-based" analysis and toward an "effects-based" and functional economic analysis.[43] To that extent, Daniel A. Crane[44] argues that

> "Europe employs legal formalism, and the United States uses economic formalism. Neither system employs an open-ended rule of reason type approach to loyalty rebates or is likely to do so any time soon. Both systems employ a mixture of functional and formal considerations."

Up-to-date US antitrust jurisprudence is portrayed by elements of both open-ended rule of reason analysis, which induces detailed economic analysis, and more rule-bound approaches to particular problems of market power, where analysis is grounded on the application of one or two-factor liability determinants. Hence, the rule of per se illegality for price-fixing agreements is an instance of a liability determinant advancing a single-factor rule.

It has to be taken into account that the courts ascertain applicable normative rules and principles, both substantive and institutional, to guide antitrust decisions. Substantive rules are those broadening the fundamental objectives of antitrust law, which are incorporated in the "consumer welfare standard." Moreover, courts evaluate the facts in a case in light of the normative rules and principles and make a decision. It is argued that antitrust courts rely on various forms of a structured rule of reason in accomplishing both functions.

The per se rule is, in any event, intended to accomplish the same ends as the rule of reason in particular circumstances in which more extended factual inquiry is considered superfluous. Michael L. Katz and A. Douglas Melamed[45] argue that

> "the antitrust rule of reason should be shaped, not just to guide correct application of existing law to the facts of the case (the second fundamental judicial function), but also to enable the courts to participate constructively in the common law-like evolution of antitrust law in the light of changes in economic learning and business and judicial experience (the first fundamental judicial function)."

In Microsoft[46] held "that the rule of reason, rather than per se analysis, should govern the legality of tying arrangements involving platform software products."

It is argued that the courts read down the statutes to strike a balance between the aspirational and pragmatic impulses; thus, courts have considered the antitrust statutes as broad delegations allowing them to generate a pragmatic common law of competition.[47] Moreover, the Court has handled the Sherman Act as a common law statute.[48] As the Supreme Court explained in Leegin, "just as the common law adapts to modern understanding and greater experience, so too does the Sherman Act's prohibition on 'restraint[s] of trade' evolve to meet the dynamics of present economic conditions," which means that the new environment of trade brings forward factors that restrain trade and which did not existed in the prior conditions of trading in an economy, but the central essence of the rule in prohibiting restraints of trade is not altered.[49] Besides, Posner[50] specifies that currently the Sherman Act is not interpreted according to the framers' understanding but judges have endorsed a more economic analysis.

To that extent, in a common law-like process, neither function can be well provided by picturing a static world in which normative legal standards and institutional considerations can be taken as fixed, and so both are treated as appropriate in the light of advances in economic learning and judicial experience that are important to the pending case, while at the same time giving proper deference to precedent.

It is worth noting that the principle/rationale of a rule is central, and merely the facts fulfill the content of the rule. Thus, the core conception of a rule does not change, but merely new events might fulfill its application as well. On the other hand, the generation of a new rationale for the same rule covering a further context means an alteration of the rule, which will encompass a new essence of the regulated matter.

Antitrust violations and, thus, anticompetitive conduct encompass actions that is not "competition on the merits," diminishing the competitive constraints imposed by rivals. Furthermore, an increase in market power is triggered by anticompetitive conduct.[51] It must be taken into account that that abusive conduct can go unnoticed as a result of a widespread "deference to innovation," and numerous merger operations have been permitted for the same reason. Moreover, the need for an extensive interpretation of the concept of "substantial lessening of competition" is central to the rationale for authorizing concentrations.

The economic analysis shows that the assessment of the net consequences of specific conduct necessitates consideration of several market elements, embracing short-run and long-run outcomes that require complex rather than simple rules.

Justice Brandeis[52] refers to the rule of reason analysis, which determines whether a restraint suppresses and damages competition or simply regulates and promotes it, and encompasses an exhaustive factual review in which nearly anything could be appropriate evidence. Moreover, Brandeis[53] considered opportunistic intermediation as anticompetitive conduct opportunism, "self-interest seeking with guile," denoting the exploitation of circumstances in pathways that are not automatically unlawful but are unfair.[54]

Can antitrust law be utilized in achieving different social goals? It is obvious that antitrust law should not be exploited in pursuing numerous social objectives.[55] Hence, there is a need for standard rules achieving clear tasks on various matters to ensure legal certainty and stability in trading. Rules must be used to achieve fair targets for society and not interpreted in a way that benefits an elite.

AI technology has led to an increase in the capacity of corporations to store, transmit, and process information. It is characteristic that information exchanges are not subject to per se condemnation; thus, the exchange of price data and other information among competitors does not always have anticompetitive consequences because, in particular settings, it augments economic efficiency, rendering markets more competitive. This means that such exchanges of information do not constitute a per se violation of the Sherman Act.[56] Also, corporations rely on live, readily accessible data and information from other corporations in making central business decisions; therefore, the exchange and use of information between horizontal competitors are linked to the competitive structure of the market in which these corporations compete. Consequently, the exchange of information between horizontal competitors can violate competition law provisions (Article 101, Section 1). Hence, the exchange of price-sensitive information may enable collusion between competing corporations[57] and information sharing can assist coordination.

It has to be taken into account that EU competition law has focused on economic welfare and, thus, the supposed "modernization" of EU competition policy denotes the promotion of the view that EU competition policy should concentrate on boosting economic efficiency and advancing consumer welfare, which means endorsing an efficiency-based, US-style conception. The "modernization" of EU competition law incorporates alterations in the interpretation and application of substantive competition law, endorsing the "more economic" approach.[58] Also, US antitrust policy remains principally concerned with the enhancement of economic efficiency and welfare.[59] Article 101 TFEU and Section 1 of the Sherman Act have been read to embrace two distinct centers of liability, and thus, the laws target both ex post collusion and the ex ante facilitation of such collusion.[60] It is worth noting that "economic collusion" denotes the situation where corporations in a given industry have prices that are higher than some competitive benchmark. It has to be taken into account that the modernization of the restriction of competition by object by the European legislator and judges is a component of a general trend to enhance the detection and repression of anticompetitive behavior.[61] Louis Vogel[62] argues that "The return to formalism and the decline of the effects-based approach at the European level is basically the result of a misuse of the concept of restriction of competition by object."

There has been a systematic and substantial move toward effects-based approaches in the DGCOMP decisions[63] by developing tools for the empirical measurement of the extent of economic analysis and legal standards in competition law enforcement, which means that legal certainty and predictability, which are the rationale of the law, are lost. It is characteristic that the choice of legal standards in antitrust enforcement is promoted to steer the assessment of possibly anticompetitive conduct, and cost of decision error principles are exploited in presenting a valuable and practical framework for scrutinizing the choice of legal standards for particular categories of conduct in competition law enforcement.[64] According to EU case law, the Commission grounds its description of the relevant market in cartel cases on the conduct of the participating undertakings, and so, the market analysis requires a coordinated conduct of two or more companies and an actual or prospective harm to other businesses or to consumers.[65] The new rules of the DMA result from the recognition of the inadequacy of traditional public antitrust enforcement in digital markets.

It has to be taken into account that the existing antitrust doctrines, rules, and antitrust enforcement "are too limited to protect competition adequately, making it needlessly difficult to stop anticompetitive conduct in digital markets" and growing market power.[66] It has to be taken into account that market power is the capacity of a corporation to profitably augment its prices above competitive levels and, as such, the exercise of market power lessens economic welfare, which means that an increase in market power echoes a drop in the effectiveness of actual or prospective competitors as constraints on a corporation's conduct. Additionally, economic theories and empirical claims about the competition effects of certain practices are utilized for constructing antitrust rules by the courts. Moreover, Italianer[67] mentions that the US Supreme Court has plainly accepted that

> "the categories of analysis cannot pigeonholed into terms like "per se" or… "rule of reason." No categorical line can be drawn between them. Instead, what is required is a situational analysis moving along what the Court referred to as a "sliding scale."

Furthermore, Douglas Melamed[68] argues that

> "Maybe law reform efforts should look instead to core principles—antitrust is about prohibiting conduct that increases market power and cannot be justified by welfare-enhancing efficiencies—and to freeing the courts to decide cases by finding facts, instead of navigating a thicket of judges' efforts to embody sometimes unsound, sometimes obsolete, and sometimes misunderstood economic propositions in legal rules."

On the other hand, finding facts out of any legal rule cannot function because there is a need to endorse common elements in investigating the competition environment grounded in law in order to achieve legal certainty, permitting a stable economic environment. Courts apply legal rules in deciding cases and not economic principles, and factors that are too many according to economic theories and

approaches lead to a divergence of elements; thus, legal rules are establishing fair competition in the market.

It turns out that modern competition law has converged too much on economic welfare and not enough on other values like fairness and equality, which initially stimulated antitrust legislation in the first place.[69] On the other hand, the law's central role is to bring fairness and equality, which is not achieved in the case of competition law by exploiting economic interests and not by implementing certain formal laws that define their tasks formally. This allows for the achievement of the best outcomes concerning social, political, and economic matters due to their implementation in a fairly functioning market, rather than permitting capital to run the market according to economic principles outside any legal framework.[70]

Also, Louis Vogel[71] argues that "the law continues to allow the development of undertakings without subjecting them either to prohibitions which are unjustified in principle, or to the constraints of formalistic rules which excessively hinder their activity." On the other hand, there is a need to define particular factors contained in standardized rules in order to achieve convergence on the matters causing anti-competitive contacts. In other words, strict formalism encompassing only basic interpretation of the formal content of a rule without any further analysis of formal rules connected to the regulated matter is not fulfilling the role of the law in implementing the rule of law and, consequently, competition law in regulating competition across all fields and topics in the market.

The utilization of the rule of law is well-kept when people understand that their lives will be wealthier if they follow the law. It must be taken into account that proof is the most indispensable element of the rule of law. Victor A. Bolden[72] argues that "proof is the rule of law's most essential element, a significance codified in legal rules, exemplified by legal theory, and reflected in the main source of belief in the rule of law, its effectiveness." Due to the fact that evidence is the fundamental element illustrating the implementation of the rule of law in a jurisdiction, AAI employed in justice will provide the most accurate answer to a problem by examining all the possible data for the occasion.

It could be said that both EU and US competition rules are written in conceptually elastic language and are interpreted by employing a mixture of rules and standards. Stavros Makris[73] argues that

> "Without openness, antitrust could become a formulaic and ineffective field of law unable to attain its core objective, the protection, and the promotion of competition. Yet, excessive openness can destabilize the Rule of Law or incite the instrumentalization of antirust. In other words, integrity requires openness, but the latter, if excessive, can undermine the integrity of the law."

On the other hand, by endorsing a kind of "sliding scale" mixture of formalism and effects-based analysis, legal uncertainty is generated which brings forward a lack of competition enforcement. In other words, formalism allows the rightful interpretation of formal rules covering all the possible occasions of competitive conduct fitting in the wording of the formal rule but not arriving at an effects-based analysis

over legal interpretation. To that extent, Geradin and Petit[74] mention that under a presumption of illegality, the assessment of such cases in the EU has relied on "old, formalistic legal appraisal standards, and (has shown) a reluctance to endorse a modern economic approach."

Concerning matters of vertical restraints and monopolization and abuse of dominance, US antitrust law relies on extensive use of economic analysis and evidence in case-specific investigations; that is, it has relied much more on a rule of reason than on a *per se* approach. The major problem in using economic analysis concerning competition is grounded on the fact that economic analysis is not a single standardized process, but many different factors can be utilized in economic analysis, which means a total divergence in the factors acknowledged as influencing competition. Hence, an estimation of anticompetitive conduct grounded in standard legal rules brings convergence and certainty in assessing the competitive environment in a market. Per se rules minimize decision error costs, and so formalistic legal appraisal standards and presumptions of illegality bring legal certainty instead of any economic analysis grounded in unparalleled economic facts. Jan Broulík[75] argues that "per se and by object legal tests tend to be more rule-like whereas rule of reason and by effect tests are rather standard-like." It could be said that on many occasions the application of the "rule of reason" is formalistic, since courts do not have to "balance" anything but simply rely on a clear-cut evidentiary process. Moreover, Crane[76] comments that "[r]ules, more than standards, provide ex ante notice of the law's command and therefore enable the law's subjects to conform their behavior to its dictates." Also, Lemley and Leslie[77] agree that "per se rules…provide certainty."

In short, general rules advance values that are important to any just law. Hence, competition rules must bring forward the values of competition and not any economic theory offering value for a particular party. To that extent, Justice Scalia has comprehended that "the trick is to carry general principles as far as it can go in substantial furtherance of the precise statutory or constitutional prescription."[78] Thus, per se rules on competition have to be employed in a formalistic way furthering the substance of the legal rule and not any economic rule to substitute a legal interpretation because we deal with competition law, and economic principles are applicable in identifying competition as an economic term. Moreover, standardized economic principles can be utilized as ex ante appraisal standards of the content of a formal rule, making the formalistic interpretation easier and, thus, generating predictability. Hence, in general, relying on economic theory to resolve issues of competitive harm is not counting on universally accepted dogma, but rather picking between competing economic theories.

In both occasions of legal and economic analysis, there is a reference to the content of the formal law in competition defining the terms, which means formalism is implicated in both cases. Justice Sandra Day O'Connor[79] noted that "[a]lthough the Sherman Act, by its terms, prohibits every agreement 'in restraint of trade,' this Court has long recognized that Congress intended to outlaw only unreasonable restraints" and so the Supreme Court first limited the range of the act by declaring that only contracts, combinations, or conspiracies in "unreasonable" restraint of

trade violated it.[80] Of course, formalistically, courts based on the law interpret the intention of the legislature, elaborating on the degree of the prohibiting "restraint of trade."

It has to be taken into account that an analysis of the competitive benefits and harms of a practice unavoidably presents some legal uncertainty as long as the analysis is not grounded on ex ante economic formality producing predictability and certainty.[81] It is worth noting here that modern antitrust law is moving away from rules encompassing ex ante limited factor liability determinants and toward standards including ex post multi-factor liability determinants. Likewise, economic modeling generates unpredictability and per se rules "give clear guidance" to businesses as to the lawfulness of their conduct.[82] Meanwhile, the EU Court of Justice mentioned in Budapest Bank[83] that business conduct hampers competition by object only when it is "so likely to have negative effects…that it may be considered redundant, for the purposes of applying Article 101(1) TFEU, to prove that it has actual effects on the market."

Competition laws in the USA, along with Europe, rely on individual assessments of competitive effects in every case, and so, it cannot be anticipated by businesses to whom competition law is directed which means that unpredictability damages the objective of competition law by bringing about over along with under-deterrence.[84] In line, Jan Broulık[85] specifies that "those who invoked predictability of competition law as a reason to modernize competition law by making it more economics based rarely warn against unpredictability caused by too much economics in enforcement." It seems that EU competition has moved from formalism toward an "economic approach which is based on the effects on the market"[86] and so by endorsing an "effects-based approach," a real "verification of competitive harm" is needed.

It has to be taken into account that the lack of predictability in enforcement hampers the preventive function of competition law. It has to be taken into consideration that competition law enforcement has to be grounded on clear legal rules that pre-exist the factual conditions of the case, generating legal certainty.[87] Also, encompassing economically informed legal categories into ex ante legal rules strengthens the formalistic application of law by furthering the spectrum of covered occasions and, thus, upgrading predictability.

It is characteristic that the Supreme Court has engaged in overt antitrust anti-textualism, causing a concurrent drop in both antitrust enforcement and regulatory power.[88] M. A. Katz argues[89] that "the appropriate relationship between antitrust and regulation is neither adversarial nor cyclical, but symbiotic." Hence, deregulation and diminished enforcement do not cause greater effectiveness and more robust competition; rather, there is an upsurge in the concentration of market power, allowing a few corporations to gain by building monopoly power across businesses.[90]

It seems that de-formalization is the latest approach in US competition law. By contrast, presently it seems that courts endorse the anti-text pattern[91] and so, consumer welfare is endorsed as the exclusive goal of antitrust.[92] John M. Newman[93] argues that "moving beyond the narrow confines of output-based

analysis enables the application of a more coherent, practical, and efficient antitrust framework."

Has the shifting of the approach concerning competition law of the US Supreme Court from formalism toward consumer welfare generated lawful implementation of competition law or a monopolization of the market relying on politics? It could be said that AAI technology will choose an objective implementation of competition law toward competitive success grounded on legal certainty and predictability, leading to an open market for competition and preventing the emergence of monopolies and oligopolies. Does the goal of antitrust law maximize the output of markets? Of course, the role of competition law is to achieve the fair functioning of the market, which means open market for any potential candidates to operate on equal terms and not maximizing economic outputs regardless of wasting global resources or other economic techniques of gathering global wealth in the hands of an elite against the well-being of the globe. It is worth noting that the maximization of wealth and consumer welfare as goals of antitrust law has led to market power encompassing the power to control competition.[94] Filippo Lancieri[95] et al. argue that

> "The decline of antitrust enforcement from the 1970s to the present was not achieved through legislative reform in response to public demand. It was the result of decisions made mostly in the shadow by politically unaccountable officials—judges and regulators—whose views of antitrust at the time of their appointment were (in most cases) not publicly known or perhaps even clear in their own minds."

As discussed earlier, US courts developed the "per se" category involving "agreements whose nature and necessary effect are so plainly anticompetitive that no elaborate study of the industry is needed to establish their illegality" and the "rule of reason" category linked with "agreements whose competitive effect can only be evaluated by analyzing the facts peculiar to the business, the history of the restraint, and the reasons why it was imposed." Like the per se rule, a presumption of illegality is also drawn with regard to object-type infringements, denoting that in both instances formalism to an extent comes out.[96] Besides, Kenneth Khoo and Jerrold Soh[97] argue that

> "the quasi–per se nature of the EU competition regime's treatment of such information exchanges may lead to significant wrongful convictions, a major cause of economic inefficiency…the increase in error costs following from such formalism is likely to outweigh any countervailing decrease in administrative costs. Thus, for a jurisdiction considering an appropriate framework to establish generic competition laws, there are good reasons to adopt a U.S. style rule of reason approach toward all instances of information exchange… highlight an instance of how overly formalistic rules may be inefficient, subverting the welfarist objective of antitrust laws."

It could be said that the rule of reason suffers from several setbacks such as vagueness, unpredictability, high costs of litigation, and problems in gathering facts; thus,

the rule of reason presents too little guidance to the business community regarding where the boundaries of allowable conduct lie. Per se rules are presented as a means of tackling the disadvantages of rule of reason analysis because per se rules enhance the predictability of analysis and litigation outcomes, thereby progressing business certainty and administrative effectiveness. Moreover, the interests of administrative effectiveness in antitrust regulation are inducing.[98]

It has to be taken into account that the rule of reason has been criticized for offering too little guidance to the business community concerning where the boundaries of permitted conduct lie[99] but, on the other hand, formalism should provide simple legal rules offering legal certainty.

It is worth noting that the per se rules allow businessmen to predict in any actual case what courts will decide to be legal and illegal under the Sherman Act.[100] Hence, litigation should not blur clear rules into vague standards[101] and courts and litigants facing vague standards seek to convert those standards into clear rules. Thus, legislation and courts have to provide definitions of price fixing unrelated to the underlying standard protecting the predictability and certainty of the per se rule.

It seems that antitrust law's per se rules simplify analysis. Sean P. Sullivan[102] argues that

> "efforts to convert vague antitrust standards into clear rules will rarely succeed without abandoning the underlying standards that the rules were meant to simplify. Second, I conjecture that failed efforts at simplifying antitrust will often have the opposite effect—increasing the apparent complexity and vagueness of this law. If these conjectures are correct, then the search for simpler rules could be not just unproductive but counterproductive in antitrust law."

The fundamental goal of antitrust law is to protect the economy against harms associated with cartels and monopolies. Moreover, the law should spell out and prohibit a specific set of abusive business practices[103] which are to be regarded as anticompetitive, thereby identifying ex ante and in a formalistic way the constraints against competition. This means clearly expressing the content of the competitive process as the legal standard for antitrust law.

It is characteristic that product industrialists have employed proprietary software and predatory design to preclude independent servicers from repairing their products and, thus, obliging customers to repair via manufacturer-authorized servicers.[104] On the other hand, the Right to Repair Movement advances competition within repair aftermarkets by reducing costs by neutralizing manufacturers' efforts at monopolizing repairs aftermarkets.[105] It is worth noting that the Right to Repair Movement and antitrust law are promoting market competition.[106]

Market concentration and vertical integration allow monopolization, while fair competition generates an AI marketplace with less biased applications winning consumer approval. T. N. Narechania and G. Sitaraman[107] argue that "Because antitrust enforcement operates ex post and on a case-by-case basis…antitrust doctrines have been narrowed over the last forty years, rendering underenforcement more likely in a sector that seems structurally inclined towards concentration,"

which means that anticompetitive behaviors endure and market power has become more intense. Hence, by endorsing antimonopoly rules functioning ex ante as market-shaping devices prevent harms by modeling market structure.

It could be said that the DMA advances barriers to entry for startups and, as a result, dampens investment in emerging digital ventures, which means that the DMA restrains motivation to take the risks needed for business achievement, eventually obstructing the advancement of revolutionary AI expansions. Hence, it seems that by advancing regulatory clarity and certainty, the EU will promote a more advantageous environment for innovation and competition in the EU digital market. To that extent, K. Afuwape[108] argues that

> "The shift in the DMA from ex-post to ex-ante rules, using per se antitrust prohibitions, fails to differentiate between conduct that fosters competition and conduct that hinders it. Consequently, the DMA overlooks the benefits of economic efficiency and conflicts with the EU's principle of proportionality."

On the other hand, competition law has to follow the principles of law based on standardized content of rules and not grounded on changeable economic factors, generating uncertainty instead of legal certainty leading to economic advancement and not economic monopolies.

Competition laws intend to deliver free, fair, and undistorted competition, which is achieved via ex ante standardized rules rather than inserting economic evaluation ratios, as that of the vague "consumer welfare" filter. It seems that US antitrust law and, to some extent, EU competition law include a "consumer welfare standard" ("CWS") filter.[109] It could be said that by adding or subtracting legal or empirical facts in interpreting legal rules, one assimilates uncertainty in the essence of competition law and market competition, which means that legal formalism is required. Competition law principles should be standardized and revised occasionally in order to incorporate new developments, but always in a formalistic way and not be "a complex aggregate that incrementally consolidates dozens of epistemological choices"[110] and so, avoiding uncertainty. It seems that the ECJ in the AGCM[111] decision incentivizes innovation in advancing market economy, regardless that the law is technology neutral, which means formalistic standardized legal principles expressing standardized economic rules and not vague economic theorizing in order to establish legal certainty upon which market competition has to be developed. Consumer interests, and behind the curtains those of monopolies, should not be the objective of competition law but only the establishment of fair competition grounded on formal legal competition rationales, thus ensuring real market competition for all participants, achieving quality economic outcomes for society and not for global monopolies.

4.3 Globalization and Competition

It is worth noting that globalization has transformed the basis for competition, and so, corporations compete in global markets which means the need for executing global strategies to sell their goods, acquire raw materials and intermediate

products or services in order to control costs in global markets. Additionally, governments have to improve competition through reforms in antitrust prosecution instead of allowing market concentration with adverse effects on competition.

There is an increase in concentration and profitability driven by corporations' capability to extract higher operating margins via higher markups. Also, the current market concentration via AI technology produces extraordinary profits and a reduction in investments in innovation. Additionally, high-tech corporations overshadow the stock market and make it difficult for startups to raise funds, thus prohibiting competition via innovation in order to achieve sustainable economic growth. Big AI corporations are acquiring smaller AI startups and projects in the early stages of their progress, thereby abolishing any future prospective competition, which means that these acquisitions reveal the desire of these corporations to pile up intellectual property, datasets, and highly trained human resources in the AI arena and so, competition is suffocated.[112]

It has to be taken into account that high-tech corporations have increased their market power, thereby diminishing market competition, which means not only higher price markups but also intensifying income inequality, generating a concern for governments due to geopolitical consequences. In line with this, D. Martínez and P Bunkanwanicha[113] argue that "governments should put more effort into strengthening market competition to deal with these challenges rather than promoting political-driven national champions to compete with superstar firms."

It seems that the revenues of high-tech corporations keep pace with governments, and so, a massive economic concentration leads to political power being in a few families' hands which means that the interface of economic and political power is a threat to the well-functioning of a free market global economy. It is characteristic of corporations find tactics to exercise their political power by lobbying government officials to gain benefits such as more favorable regulations that permit them to freely implement their market power or receive government contracts.

It is characteristic that high-tech corporations are exploiting their monopolistic power over customers, suppliers, and employees to retain their extraordinary profits and, via their political power, prolong their dominance at a high cost to society. Hence, the concentration of power in a few corporations has caused a rise in income inequality, with a high return for shareholders at the cost of a deterioration in labor part.[114] To that extent, D. Martínez and P Bunkanwanicha[115] argue that

> "Superstar firms have developed their competitive advantages levered in technological improvement and innovation, augmenting sales at a much higher rate in relation to workforce increase. This effect has generated wealth creation for superstars' shareholders at the cost of the labor force, increasing inequality. This unequal structure in which superstar firms are far from the laggard firms will continue penalizing labor share and generating inequality. Regulators need to look for tools to improve competition within these industries, such as facilitating access to funding for start-ups and reducing regulatory and artificial barriers to competition."

Governments have to break down barriers artificially built by corporations with high economic and political power. Hence, there is a need to properly supervise market power via a plain disclosure of corporate activities. On the other hand, dominant corporations seek to uphold their dominant position via acquisitions, which is a legal way of advancing the status of a corporation. Thus, achieving high standards of growth via innovation and productivity in fair competition is the motive for business. Fabienne Fel[116] illustrates that "the next generation of products manufactured in France will replace current foreign supplies, which will have become obsolete." Hence, there is a need for France to improve competitiveness via its high prospective for innovation and modernization.

Can AAI technology prohibit monopolies? First of all, the current AI systems are utilized by humans in order to achieve monopolies more easily and contribute to preserving the downsides of the current human society regarding competition, labor, health, etc. It could be argued that AAI corporations will have large structures in order to be functional in controlling vast volumes of data to keep competition and other social aspects of life at an objective level, enabling the fair rolling of AAI society. Moreover, it has to be understood that AAI humanoids will have different needs and social lives than humans and so AAI systems might be able to fulfill their needs easily as long as they are merely electronic entities dependent on the central AAI systems for survival. On the other hand, if AAI society is developed along a parallel path to that of humans' society and merely functions at a different technical level, then the solutions for AAI disputes will be more complicated and not easily controlled, which means that the malfunctions in human society will emerge as well.

Banks are endorsing platform-based business models that are more customer-oriented and offering user-friendly services. The "platformization" denotes a transfer from individual products/services to platforms as intermediaries for transactions and, in doing so, generating value design courses, which means advancing the formation of ecosystems in delivering products and services within the platform by producing value for both its users and the platform owner.[117]

It has to be taken into account that AI innovation and digitalization have generated new tasks for incumbent banks by forming new market standards and altering their competitive landscape due to consumers' expectations and uses. In line, R. Coeurderoy and M. Guilhon[118] argue that "Banks are facing paradoxical pressures between conformity to their core activities in which they are perceived as legitimate, and differentiation that could help them renew their competitive advantage."

If the competitive process functions well across an economy, it drives overall investments, innovation, and productivity growth. Also, competition is valuable to customers, leading to long-term growth. In other words, competition should first focus on the employment of a standardized competition process followed by all corporations, and via fair competition process, the whole economy will advance properly by distributing all the gains to society and not allowing competition to cause monopolization of various sectors of production and services.

Taking into account that market power has augmented across the global economy, competition law has failed to ensure competition for the participants; thus,

competition law enforcement has been abandoned. Additionally, it should be considered that dominant corporations are shaping the public debate by promoting competition economics rather than competition law enforced in a formalistic way. The uncertainty generated by competition economics should not be normatively acceptable in the assertion that competition economics actually benefit consumers which in great numbers is not true if quality matters are counted in the evaluation of consumers' benefit. In other words, competition law cannot be treated in terms of competition economics.[119]

4.4 AI and Competition

It is characteristic that the digital revolution comprises a great success of the market economy by stimulating vibrant competition in the markets.[120] The advancement of the digital markets has generated a disproportionate concentration process, and so a few large platform undertakings have reached a dominant position in some markets becoming "gatekeepers."

It has to be taken into account that sovereignty with reference to digital markets focuses on the control of the flow of data, the capability to set standards in achieving interoperability, along with the implications of the acquisition of significant economic power by digital corporations.

The achieved market power permits Big Tech to expand their activity in other sectors and build synergies between different products and services, triggering a sort of "ecosystems" where new entrants cannot enter, which means that it is easy for them to misuse their dominant position. On the one hand, antitrust laws protect fair competition, but owing to the lack of fairness standards and clarity, corporations exploit efficiencies that could allow them to expand the appeal of their products and services. On the other hand, Big Tech monopolies have abused their control over access to markets by choosing winners and losers throughout the economy in their favor by discriminating among third parties, entering new markets, establishing their monopolies, and misusing their power.[121]

It seems that states have emerged as monopolists because of privatization. Gregory Day[122] argues that "collusions among private actors and states have not only oppressed marginalized communities, but also imposed society's most durable monopolies. To uphold principles of federalism, but also rectify state oppression, courts or Congress must abrogate state action immunity in its entirety."

New technology giants have won market dominance via the collection, analysis, and synthesis of data, indicating that the increasing dependence on digital technology through data gathering is a precondition for economic participation. Moreover, the US Department of Justice[123] recently specified that American Big Tech corporations pose "a threat to open markets and competition, with risks for consumers, businesses, innovation, resiliency, global competitiveness, and our democracy." It must be taken into account that the digital platform business model has grown, and there is a need for the economic analysis of platform competition.[124]

Digital platforms use AI to personalize their services or products, thereby augmenting their installed base. Moreover, platforms activate the data network effect,

and by utilizing AI, data collected by certain technology corporations gives them a competitive advantage that is nearly impossible for rivals to match.[125] To that extent, Big Tech corporations have become gatekeepers in digital markets, making their positions unquestionable due to the function of platforms generating operating systems, app stores, online marketplaces, and search engines. These markets have strong increasing returns, which are instigated, among others by network effects. Moreover, multiplying returns lead to competition being for the market rather than in the market[126] and so, in a killer acquisition, the acquiring undertaking tries "to discontinue the development of the targets' innovation projects and pre-empt future competition."[127]

Taking into account that digital platforms set restrictions on participation, development, or use across their clear-cut roles, platforms clarify how "open" they are to users and developers. Thus, the utilization of AI technology can achieve the best point of balance in order to have the best possible outcome due to the fact that the highest volume of data on the openness can be taken into consideration by an AI system. Also, it seems that acquisitions lead to lower than optimal levels of openness. To that extent, J. Manuel Sanchez-Cartas[128] argues that

> "a platform always has an incentive to acquire or imitate complementors. Which one is preferred depends on whether the increase in platform value (acquisition) offsets the market expansion effect (imitation)…acquisitions reduce openness and welfare but may generate more valuable complements while imitation increases openness and welfare but may harm third-party developers."

As mentioned earlier, Big Tech monopolies have abused their control over access to markets by establishing their monopolies throughout the economy, utilizing and bending the playing field in their favor, and expanding into new markets by utilizing their power in many ways.[129] It is argued that Big Tech corporations, as a result of their market position, shape terms and protect and extend their market power.[130] Hence, it is characteristic that digital companies have expanded the range of their economic activities through internal growth and acquisitions.

AI expands the situations in which known forms of anticompetitive conduct, mainly conscious parallelism or tacit collusion, take place. Moreover, the use of algorithms brings newer types of anticompetitive conduct, confronting traditional antitrust orthodoxy with new elements such as price discrimination, co-opetition, data extraction, and data capture. Additionally, deception is integral in algorithmic markets, prompting consumers to take part in manipulative transactions.

AI and digitization increase competition in many ways, but simultaneously, altering technology brings new sources of concentration, embracing powerful network effects. The digital economy boosts large digital platforms that rely profoundly on direct and indirect network effects to grow, holding high market shares and thus altering competition. It could be said that AAI technology, by implementing AAI competition law formalistically created, will automatically intervene, canceling any anticompetitive conduct of digital platforms and thus allowing an objective application of competition law to accomplish fair competition.

Current antitrust means tackle some prospective anticompetitive outcomes of information exchange linked to AI platforms if they act as a hub for systematic information exchange.[131] A correct definition of the relevant market is a prerequisite for any assessment of the effect of a merger on competition.[132] Price fixing and collusion could be detected in the communications between businesses affecting competition, but the task of discovering detrimental price behavior becomes more difficult with the use of AI algorithms for setting prices, leading to unwanted price behavior, sometimes even unintentionally. Additionally, the use of advanced algorithms to set prices and adapt product functionality increases opacity.

There is a need for formality in the rules applying to the utilization of AI systems and the consequences of any failure. In other words, there is a demand for formalism in regulating AI implementation according to the seriousness of the consequences of any failure.

4.5 Formalism and AAI Neo-Formalism in Competition

Formalism is stated as a group of opinions about legal interpretation that embraces both textualism and other opinions considered correct interpretation in line with the original legislative intentions.[133] It could be said that formalism denotes obedience to the rules, which means that formalism should provide legal rules offering legal certainty. K. Llewellyn[134] stresses that formalism is based on "canonically" written language of rules. Moreover, M. Horwrrz[135] argues that formalism is a way of denying the diagnosis of influential functions of law. Furthermore, Tushnet,[136] tells us that formalism incorporates an artificially restrictive array of interpretive choices.

Also, R. Unger[137] specifies that formalism belongs to a compelled and relatively apolitical decision-making process. However, law, with its wording, identifies the regulated matter under particular terms, and politics cannot intervene in order to achieve its desired decision, promoting particular interests via a special economic theory. In addition, according to Kennedy[138] formalism is grounded in the viewpoint that rule application is mechanical, and so, the mechanical application is fair. Felix Cohen[139] finds that formalism is a "philosophical basis" for "objectifying" legal concepts. Likewise, Strauss[140] says that formalism is a denial of acknowledging the practical aftereffects of judicial decisions. It is argued that decision-makers[141] take all factors they believe to be relevant into account, or at least that they feel obliged to reach "reasonable" results, whether or not the language of the rule points in that direction.

It is worth mentioning that formalism is a practical working instrument used in law, economics, and other disciplines.[142] Hence, it has to be stressed that competition formalism amalgamates formalistic rationales from law and economics. Also, it is argued that formalism can be implemented in both law and economics.[143]

"Formalistic" is a normative architecture that restricts the scope of "family likeness" open-ended definitions to sets of needed and appropriate conditions. Thus, formalism involves a method of construction by disconnecting legal application from normative or policy considerations. Jonathan Yovel[144] argues that "formalist construction appears in degrees and can be functionally motivated."

It is characteristic that views of formalism implicate the notion that rules constrict the choice of the decision-maker, and so "formalism" denotes the decision-making according to rule, which means that it is the very idea of decision-making by rule. Hence, there is a need for precise rules in order to achieve certainty via predictability. Otherwise, there will be a divergence on regulated matters such as in competition case law where various economic calculations are considered as the picture of anticompetitive conduct, leading to a relaxed applicability of competition rules. It is representative that formalism is unfolding an over-reliance on canons of decision[145] and so formalism reveals that legal decision-making fulfills instrumental functions.[146]

It is argued that legislation on any subject will encompass gaps and errors that judges fill and correct when cases bring to light problems that the legislature could not and/or did not foresee.[147] Hence, the legislature may not predict every situation to which its statutes will apply, and so, writing in general language, it cannot cover every occasion that, with a rightful interpretation, will be enclosed and regulated by the content of the rule. Statutes are the instrumentalities by which policymaking institutions accomplish their mission by determining society's organization, and courts are implementing statutes. There is a need for the typical *legal* way of interpreting doctrinal categories and structures of the law. On the other hand, it could be said that textualism offers certainty in the law, predictability, and respect for the rule of law. Thus, legislators enact and judges interpret texts without incorporating extraneous matters. To that extent, Justice Scalia explains that the court's "regular method for interpreting the meaning of language in a statute" is to "first, find the ordinary meaning of the language in its textual context; and second, using established canons of construction, ask whether there is any clear indication that some permissible meaning other than the ordinary one applies."[148] Moreover, Daniel A. Farber[149] argues that "the vices of formalism are excessive confidence in the power of 'the word' and excessive distrust of the ability of judges to exercise good judgment." Judges cannot insert meanings or economic or social effects that alter the central understanding of a term encompassed in a formal law because the implementation of the law has to achieve the goals attributed to the law by the legislature, and so, judges cannot establish via their judgments a new law but merely elaborate on the central rationale of the law without altering the task of the legislature.

It is worth noting that judicial power is employed for the rationale of giving effect to the will of the legislature, being the will of the law and not that of the judge. Moreover, textualism generates greater certainty in the law, which means greater predictability and respect for the rule of law.[150] Also, it could be said that any jurisdiction adopting laws cannot survive without the belief that words express apparent meanings and without the loyalty of legal arbiters to conform to those meanings.[151] In line with this, Daniel A. Farber[152] argues that "formalist interpretation, ultimately, relies on a faith in the raw power of the word to communicate, as if the perplexities of statutory interpretation were due merely to legal sophistry."

It has to be taken into account that the antitrust laws apply to commercial conduct touching interstate commerce and so, they have to be appropriate for a vast and ever-changing array of conduct and conditions, the consequences of which

might be apparent only after extensive, detailed, and particular factual inquiry. Hence, Congress has delegated to the courts the application of both the normative standards to be applied in evaluating conduct and the process by which courts decide whether these standards are violated, which means that this delegation "permits the law to adapt to new learning." It could be said that none of those terms are defined in the statutes and so, enabling flexibility. On the one hand, the imprecision of the statutes is probably a good thing, but on the other hand, imprecision brings uncertainty and differentiation in rationales for achieving precision and accuracy on the regulated matter and the conditions of protecting a market function such as competition.

It has to be taken into account that the law-and-economics (L&E) followers examine what legal rule will best promote economic efficiency and, on the other hand, originalists in constitutional interpretation and textualists in statutory interpretation (O&T) followers discern the original public meaning of the relevant legal text.[153] Hence, it could be said that O&T is legal formalism and L&E is economic formalism, denoting two formalisms, and a judge stereotypically will reach the same result using either L&E or O&T, since L&E and O&T operate as mechanisms for justifying results reached on other, unstated and normative, arguments. Anyway, the law's content is adequately determinate to stipulate guidance in permitting the law to play its central coordination purpose.[154] Moreover, Congress legislates clear interpretive rules.[155] In Pacific Bell v. linkLine[156] the US Supreme Court has followed economic formalism by rejecting price squeeze liability, and so, the linkLine decision rests on the interaction of two legal doctrines: the absence of a duty to deal and the right to price at any level above marginal cost.

Are O&T and L&E neutral, objective, and determinate? Do O&T typically direct judges to apply L&E? What counts as a cost that must be encompassed in the analysis? Neil H. Buchanan and Michael C. Dorf[157] argue that "L&E and O&T typically obscure, rather than substitute for, normative value judgments." Statutory language like "appropriate and necessary" does not rule out cost-benefit analysis, but it hardly demands such analysis.[158] To that extent, L&E itself, involving cost-benefit analysis, is often unspecified. Todd Zywicki[159] believes that L&E and O&T are not just compatible but complementary. Additionally, L&E and O&T are both formalistic in the substance that they intend to generate results without reference to normative considerations, and so, formalism is exploited in order to have the best outcome in resolving disputes on a particular matter. In this context, Maggie Gardner[160] debates for certainty on the reason that where there is ambiguity, uncertainty, and subjective stimulation, judicial selection is complicated by subjective judging.

On the other hand, the economic theory underlying L&E is intrinsically subjective, utilizing a policy or set of market interactions grounded on a set of assumptions that is no more objective than any other set of assumptions. Hence, there is a need for utilizing the proper legal baselines that govern and enable market interactions. To that extent, Neil H. Buchanan and Michael C. Dorf[161] argue that

> "L&E and O&T provide objective-looking approaches that can in fact be adapted to any subjective priors that a scholar or judge might have, it would be possible for liberals and progressives to purport to have discovered objective theories that quite reliably produce left-leaning results."

It is characteristic that the core antitrust statutes are very brief and imprecise[162] and the Supreme Court[163] rationalized that "[t]he legislative history makes it perfectly clear that [Congress] expected the courts to give shape to the statute's broad mandate by drawing on common law tradition." Moreover, the antitrust statutes are broad and general, and antitrust law applies to almost all viewpoints of commerce, but Judicial decision-making in antitrust has to adjust to any new technologies, business models, and market circumstances. Hence, existing principles can be adjusted to new business practices and market circumstances. To that extent, Justice Scalia[164] commented that "[N]o statute, can be entirely precise, and…some judgments, even some judgments involving policy considerations, must be left to the officers executing the law and to the judges applying it."

Can formalistic rules undermine the objective of antitrust laws? It could be said that formalistic rules promote the objective of antitrust laws, which is concentrated on advancing a competition process based on certain ex ante legal rules that generate certainty and predictability which means that the rightful application of competition law will result in good economic outcomes for all parties in the market. By setting consumer welfare as the goal of antitrust law, which is a vague term encompassing an endless scale of values, it opens the road for various methods of achievement regardless of any certain legal rules denoting the anarchic way of arriving at economic results regardless of an equal competition environment for all parties in a market, leading to economic monopolies and market power.

It is characteristic that as economic analysis gradually informed antitrust law and policy, both courts and enforcement agencies recognize, on economic grounds, that some set of agreements must remain beyond Section 1 scrutiny. Hence, although the formalistic model of Section 1 embraced by United States v. Yellow Cab[165] entailed courts to make such examinations, it is gradually acclaimed that the condemnation of intra-enterprise conspiracies is deeply "orthogonal" to the fundamental antitrust objective.[166]

It has to be taken into account that the economic analysis is displacing previously long-standing, formalistic models in antitrust, ranging from merger analysis to the use of vertical restraints and vertical integration. It is argued that the Sherman Act made a fundamental distinction between "unilateral" and "concerted" conduct and refused to condemn "coordinated conduct among officers or employees of the same company" which means that parent and subsidiary corporations set up a "single economic unit" that possessed "ultimate interests…[that] are identical," the officers of each corporation were not "separate economic actors," rendering Section 1 inapplicable.[167] On the other hand, a single corporation contains many competing interests leading to the collapse of many companies' running.[168] It is worth mentioning here that while the court heavily presumes that intrafirm decisions are independent and driven by the boosting of profits, "in rare cases,

that presumption does not hold"—as it did not for NFLP.[169] Hence, NFLP simply functioned as an instrument for the separate team decision-making, rather than acting as a single source of economic power itself. Justice Stevens[170] maintained that the court "eschewed such formalistic distinctions" as to whether the parties are "legally distinct entities" in deciding whether behavior establishes "concerted action" and so illustrating a rule for considering an integrated multi-component company as a single actor for reasons of Section 1 and removing the unity of interest inquiry away from incentive alignment and toward control rights, in line with the economic theory of the company.

On the one hand, if the NFL is just a "single entity," its teams are immune from liability under § 1 of the Sherman Antitrust Act, which regulates combinations, contracts, and conspiracies in restraint of trade. On the other hand, if not, its teams possibly face antitrust litigation over the reasonableness of their cooperative activities due to the fact that a central distinction in antitrust law between "concerted" and "unilateral" conduct is the underpinning for the "single-entity doctrine" of dividing defendant businesses—all of which comprise multiple persons—into "single entities" immune from § 1 liability and cooperative arrangements among multiple entities subject to § 1 scrutiny.[171] In Monsanto, it was decided that unilateral conduct by a single company acting independently is "not proscribed" by § 1.[172]

Antitrust law makes a fundamental distinction between "concerted" conduct among multiple entities and "unilateral" conduct of single entities. Under the "single-entity doctrine," § 1 of the Sherman Antitrust Act is inapplicable to the latter. Moreover, it is argued that the problem stems from the unavoidable fact that the "agreement" requirement of § 1 is itself a formal rule, not an economically meaningful standard. To that extent, the tension between such a formalistic requirement and an increasingly economics-based antitrust jurisprudence has resulted in the Supreme Court not expressed a clear and predictable standard for the application of the single-entity doctrine over the last century. To that extent, J. Schmitten[173] argues that

> "a solution that embraces the formality of § 1's "agreement" requirement with a formalistic rule for determining business organizations' single-entity status. Under this approach, whether a business constituted a single entity for § 1 purposes would depend entirely on the "form" into which that business was organized. The courts would simply choose the "forms" into which persons must formally organize themselves in order to obtain § 1 immunity and then use antitrust regulation of mergers to police self-sorting into those forms. This would reduce the indeterminacy of current doctrine, which should appreciably reduce the administrative costs of antitrust litigation without a comparable risk of an increase in error costs."

Hence, concerning the formalism of § 1's "agreement," the Supreme Court has to develop an exclusive list of corporate forms that constitute "single entities"[174] becoming a formalistic solution to the current doctrine's indeterminacy.

It has to be taken into account that strictly general formalistic reasoning without any deep formalistic interpretation of the entire scale of the formal rule in antitrust often generates perverse results[175] and in line, J. Schmitten[176] argues that "Formalism—used here to refer to an antitrust policy explicitly concerned with 'form' rather than 'substance'—is a dirty word in antitrust scholarship."

Antitrust formalism consists of commitments to interpretations of the antitrust laws that oblige courts to discount and even ignore relevant competitive effects. Thus, it involves the use of rigid rules resting on premises that are correct under some settings but not all, denoting the demand for a formalism that encompasses an effort to include all possible understandings of the matter involved in the formalistic interpretation of the formal law. Examples of antitrust formalism include per se rules, the analysis of collusion, the interpretation of the distinction between horizontal and vertical restraints, the "direct-purchaser" doctrine, and the per se rule against price fixing.

It could be said that competition law rules that downplay competitive effects appear to run afoul of the objectives of antitrust and, as such, antitrust formalism is counterintuitive because antitrust formalism involves commitments to interpretations of the antitrust laws demanding courts to discount and even ignore relevant competitive effects.[177] To that extent, Barak Orbach[178] argues that "in antitrust law competitive effects should matter and their exclusion through formalism is unsound." However, implementing formal rules in a formalistic way that encompasses all the settings fitting into the particular formal term will have the required outcome settled as the goal of the legislature in passing the particular law, such as in competition law, which will be the result of the formal implementation of the rule and not looking for favorable economic outcomes in order to argue that there is rightful competition enforcement. This is because the economic outcome has to come under the implementation of formal rules favoring equally the whole market and not favoring the parties that have achieved better economic results regardless of the legal environment under which those economic results have been achieved. In line with this, K. Khoo and A. Sng[179] argue that "the 'formalistic' approach stands in contrast to its "effects-based" counterpart, where the authorities are required to establish actual anticompetitive effects in the relevant market."

In a "formalistic" approach to Competition Law, liability is often ascertained pursuant to presumptions of law permitting the authorities to infer liability upon proof of certain conduct; thus, the "formalistic" approach stands in contrast to its "effects-based" counterpart, where the authorities are necessitated to ascertain actual anticompetitive consequences in the relevant market. A formalistic approach should not only favor rigid rules but also more flexible and context-specific standards evaluating competing interests in a formalistic way, thus allowing the best solution for the competition process in achieving the best outcome for the market. It must be taken into account that adherence to the rule of law means that law enforcement is predictable, bringing legal certainty[180] which means that competition law is predictable.[181] M. Schwarzschild[182] argues that

> "Predictability ranks fairly high among the legal virtues. It is part of what people mean by the Rule of Law. When the law is uncertain, human autonomy itself suffers, since without knowing what is permitted and what is forbidden it is less safe to act at all".

On the other hand, Marcin Matczak[183] considers that judicial decisions based on formalistic reasoning challenge predictability instead of promoting it. Moreover, competition rules are adopted in order to prevent certain harms resulting from a restriction of competition, and this is achieved via ex ante principles of competition law discouraging and preventing companies from engaging in harmful conduct by making it illegal.[184]

Formal per se rules generate legal certainty, but the interpretation of the content of formal rules has to be extensive in order to encompass all possible rationales expressing actual contacts in the field as part of the interpreted formal content of the formal law, denoting that formalism does not mean exclusion of any new rationales fitting the content and context of a formal law without counting on vague economic effects. Principles count first, and the outcomes of their implementation will fulfill their goals which in the case of competition law is generating an environment of fair competition grounded on a defined competition process based on rationales and doctrines. This means legal certainty and predictability, which is the main scope of the law as well. To that extent, Frederick Schauer[185] argues that

> "I do not argue that formalism is always good or that legal systems ought often or even ever be formalistic. Nevertheless, I do want to urge a rethinking of the contemporary aversion to formalism. For even if what can be said for formalism is not in the end persuasive, the issues should be before us for inspection, rather than blocked by a discourse of epithets."

On the other hand, if there is no decision according to the rules, then what is the role of having rules if their content is not applied as it is expressed by the legislature? Schauer says that the charge of formalism implies "narrowness," but there is a need for "narrowness" because precision brings forward particular wording, and in any other case, vague wording and incorporating a range of events and notions leave the disputed matters unresolved, leading to a divergence, uncertainty, and unpredictability of what is rightful.

It is argued that formalism in Lochner[186] is focused on the absence of reference to political, moral, social, and economic choices implicating a direct reference to the content of the applied rules; thus, the judge is explaining a clear-cut statutory scheme. Of course, the interpretation of the content of a rule according to standard features denotes formalism under the understanding of applying formal rules and not looking for sporadic elements scattered from various occasions in order to give an alternative interpretation, which will not only fail to solve the disputed matters but also create a vague understanding, leading to uncertainty about what is rightful. In other words, even if there is room for debate about the application of a general term to a particular case, the acceptance of a very broad interpretation might lead to a situation where there is difficulty in finding the precise content and context for

applying a rule, thus generating uncertainty and unpredictability for a particular matter such as in competition cases and so that the parties will not know what constitutes uncompetitive conduct, which means damaging the enforcement of competition rules and hinders the achievement of a fair competition environment.

H.L.A. Hart[187] certifies that legal terms have a substance of settled meaning and an unsettled meaning, and so Hart regards formalism as the refusal to acknowledge, in cases of doubtful application, that the wording goes far beyond simply ascertaining the meaning of a word. On the other hand, on many occasions there is a need to formalize the content of the wording of a rule in a precise manner in order to achieve legal certainty and predictability of the law, rather than relying on effects of the employment of a rule, which might be too numerous, leading to many divergent judgments of a disputed matter. In other words, formalism is the choice of endorsing and applying certain legal rules defining a matter such as fair competition or anticompetitive contracts, and not encompassing various outcomes from different but correlated subjects in order to have a judgment accepted by particular interests to satisfy any political or social wishes against the rightful application of the endorsed rules. It is worth mentioning here that the principle of drafting is to translate policy into legislation; drafting is a technical skill that is reducible to a body of rules, which plainly denotes that politics, via governmental party policies, are forming the content of any law which means that politics affect the formation of any law not to mention the impact of politics upon the enforcement of laws.[188]

Schauer says that the application of "the norm involves a choice not determined by the words of the norm alone," but there is a demand for defining the norm and not allowing an overspread of meaning to be enclosed in a norm regulating a particular matter and so requiring a formality achieved via the standardization of the wording of the norm and its context, which means that in any other case there will be an endless discussion of the breadth of the norm, continuously accumulating elements in order to interpret the norm.[189] It is characteristic of the utilization of economic terms and outcomes in the case of competition, where too many economic theories can be exploited in defining or outlining fair competition, pro-competitive, and anticompetitive contact. In other words, ex ante formal rules defining all matters of competition and the competition rules are required in order to achieve rightful competition enforcement and not to employ economic or social principles to achieve political outcomes concerning competition by baptizing them as competition rules instead of endorsing a legal formalism of standardized legal rules.

Does formalism mean limitation of choice? On many occasions the court's decision abides by the statutory language and, therefore, restricts the choices open to the judge, which means following a formalistic application of the law in order to achieve the precise demands of the legislature on a particular dispute. Can a formalistic decision-making process be condemned as long as it complies with the formal law? Of course, resolving a disputed matter by following the clear wording of a formal law does not mean an unfair judgment[190] and, on the other hand, encompassing many other principles grounded in economic or social principles in the interpretation of the content of a rule claiming an adjustment in the context of the rule often leads many times in judgment not achieving the goal of the legislature

but merely going along with politics rather than establishing a legally rightful precedent. It is essential to be "formalistic" and, therefore, endorse a narrow reading of a term in order to achieve certainty in regulation and real application of the law rather than contributing to a lax application of the law, which means not achieving the real goal of the rule. In the case of competition, the goal is that of implementing competition rules in defining the essence of competition, the competition process and anticompetitive conduct, and not merely to accumulate economic elements in order to satisfy consumers as a political task, which could lead to monopolies rather than implementing fair competition in a market open to all candidates.

It has to be taken into account that judgments are mechanically deducible from the language of legal rules because the law is a "closed system," not allowing the encompassing of any factor as part of its content under the mask of interpretation which means that a judge cannot be condemned for a formalistic approach in merely applying the rightful perception of the employed term and thus accomplishing legal certainty and predictability as it has to take place in competition cases. It is characteristic that Judge Posner[191] assumes that formalism is inapplicable to statutory rules for the reason that the decision to take these rules plainly is itself a choice in order to achieve the goal of the law and not endorse vague interpretation, in the name of not being formalistic, leading to divergence of standpoints and inapplicability of the real meaning of the law. Thus, it could be said that "formalism" entails "deductive logical reasoning" in applying the law and deriving from the content of the formal rule and not employing factors from various fields in order to relax the content of a rule, as it takes place in competition by employing economic theories in implementing competition law. Finally, Judge Posner concludes that formalist reasoning has no application to the interpretation of canonical texts.

It is argued that legal formalism[192] is better than other modes of construction for the reason that it best assists the reliance, expectation, enforcement, and other concerns characteristic of the given legal relationship. For instance, strict rules of construction in contract interpretation on functional grounds are promoted.[193]

It has to be taken into account that legal systems inevitably necessitate the interpretation of regulatory language[194] regarding the rationale of the regulation, which in competition law has to be fair by defining the competition process and anticompetitive conduct rather than endorsing economic profits for consumers. This is necessary in order to define fair competition via the implication of economic factors and theories that do not lead to convergence and legal certainty, rather than a lax understanding of competition permitting monopolies to flourish.

Law is a mechanism for accomplishing social purposes, but in some situations, there is a need for general abstract rules in order to precisely define the regulated matters, which means that it necessitates a formalistic approach in resolving disputes on the particular matter. Formalism is an approach tolerable to the undertaking of correctly resolving problems confronted in law. Moreover, "Formalism" involves legal positivism, meaning that law is well-defined under formal rules, distinct from "morality."[195] In addition, Paul N. Cox[196] says that "Law…is an instrument of social policy to be used for socially desirable ends," but on the other hand, the content of the law has to be specific in order to regulate a particular matter

and not illustrate a vague social term demanding vague moral explanations like sociology. Hence, law is specific to situation types or categories, incorporating the norms of real people in the real world[197] which are formalized and standardized to the possible degree in order to achieve legal certainty because the endorsement of a sociological analysis or economic one for legal matters is not leading to legal predictability. Thus, it has to be taken into account that legal interpretive rules must be durable which means that their application be predictable, neutral, consistent, and objective. In fact, legal formalism encloses predictability, stability, and certainty. Hence, formalism is keeping the rule of law, stability, and certainty in legal judging.[198]

It has to be taken into consideration that law prevalently directs activity and, therefore, law is dynamic in a dynamic society, but always in a definite context in order to achieve legal certainty and predictability, thus touching its formalist conception. Of course, social or technological conditions are changing, demanding new and different laws; however, its content has to be formally precise, enclosing legal principles that are formally defined and not being social terms that demand sociological or economic analysis. Even the content of legal rules, such as in competition law, can encompass economic terms that are specifically defined and do not allow imprecise interpretations, which means different judgments and thus a non-converging outcome leading to legal uncertainty.

It could be said that formalism denotes that the law consists of rules appealing to rule of law[199] values which means that rules allow the regulated subjects to facilitate the prediction of the legal effect. Hence, formalist adjudication means not departing/deviating from the known meaning of a rule and so not undermining or destroying the reasons for rules, such as in the case of competition, where the prevalence of economic analysis in deciding the implementation of competition law has led to a lack of strong competition enforcement via a divergence in defining anticompetitive conduct, fair competition or determining the competition process itself, allowing the emergence of monopolies instead of an open market for all prospective candidates to engage freely in trading.

Does formalism characterize an uncritical reliance upon the "facts" found in legal proceedings? Formalism entails fact-finding, and objective rules are favored over vague standards, as standards necessitate or enable the assessment of more facts and thus give primacy to formal rules via factual evidence. Hence, formalists not only prefer abstract and general rules but also particularized or specialized rules, as long as their content can be defined precisely, not allowing a vague interpretation leading to multiple judgments. Real formalism does not encompass the suppression of facts; on the contrary, formalism gives facts the meaning echoed from formal rules and not vague social norms. Additionally, formalism does not implicate vague economic theories, and subsequently, definite economic factors are taken into consideration in an economic formalism approach, which can be employed by legal formalism which means that formal economic rationales can be incorporated into legal rules implemented in a formalistic way. Paul N. Cox[200] says that "formalism is both viable and, at least to me and perhaps a few others, attractive…Formalism requires restraint in the form of a tolerance of apparent

injustice, apparent absurdity, even apparent evil." On the other hand, formalism means implementing the law in a way that brings forward standardized standpoints dealing with the implementation of the tasks of the legislature in strictly legal terms via legal rationales and not applying social understandings in a vague way in order to fulfill political and economic ambitions, thus arriving at divergent judgments, which means not achieving legal certainty and predictability. Hence, formalism does not denote unfair justice or judgments grounded on unsound rules.

A useful example of utilizing formalism is the investigation of negotiable instruments, and the formalist position asserts that the question of whether any person in possession of a negotiable instrument is a holder in due course necessitates comparatively clear and formal demarcation standards, for the reason that holder in due course status is a weighty consideration for anyone who thinks of taking an instrument as a cash substitute or a credit instrument. To that extent, Merrill and Smith[201] comment that "negotiability imposes very strict formality requirements precisely in order to reduce the need to measure the reliability of an instrument." In parallel, it could be said that in the case of competition, the competition law rules have to be clear, requiring relatively distinct and formal demarcation standards concerning the factors taken into account in order to define anticompetitive conduct, defining competition process and fair competition so as to achieve legal certainty in reaching rightful competition enforcement. In other words, there is a need for a formalist architecture of rules. Furthermore, there is a need to understand formalism in a manner that, while retaining the importance of form, does not disconnect it entirely from the functional context of relations.

Legal formalism and linguistic formalism are struggling for systematic perfection of expression or performance, or both, and so, formalism maintains the ex ante value of systematic and general, clear-cut, bright-line rules stimulating predictability and efficiency. Also, the justification of formalism that underlies Broadway Management is that in an area of practice assessed by a demand offering certainty.[202] It could be said that a stricter formalism is required in some areas of private law, such as in competition law, rather than other areas. In line with this, J. Yovel[203] argues that

> "Relational formalism emerges as formalism in practice, where determining what belongs to the category of form and what belongs to context is itself a matter of application and construction…The court that values adherence to valid, binding legal rules and understands its own role in terms of enforcing them is the court that applies strict formalism…Relational formalism emerges from this study as a practical operative jurisprudence that is preferable both to strict formalism and to all-out realist adjudication."

It could be said that formalism is a useful interpretative approach for competition law. Formalism is a device serving the interests expressed by the law and not superseding those interests, which in the case of competition law is translated into promoting a standardized anticompetitive conduct and a defined competition process for rightful enforcement of competition rules in order to achieve fair competition and not monopolization of the market.

It seems that formalism is grounded in the proposition of the "rule of law," which takes for granted the law's capacity to manifest the diverging interests in society. On the other hand, it seems that the ruling elite has relied upon the "rule of law" to authorize its power and resist "would-be usurpers"[204] but the rule of law should promote the real interests of a society and not merely the interests of an elite against the good of people/society. Furthermore, formalism is grounded on the fact that law can be understood from within its formal content, which means that formalism necessitates an interpretive method that relies on the text of the relevant law while lessening extratextual sources of law, thus generating legal certainty.[205]

It has to be taken into consideration that law produces social order, which means that law must be practically effective, and so, law is capable of generating and sustaining order. Moreover, the rule of law denotes deliberative formalism due to the fact that law functions as an authoritative source of normative guidance, and so, the law must be fit for use as such, which means that in order to be guided by law as an authoritative source of normative guidance, an engagement with it in a deliberatively formalistic way is required essentially. Furthermore, law is supposed to be an authoritative source of normative guidance offering effective normative assistance by concentrating on the structural formality of law along with the deliberative formality of legal reasoning. Additionally, the new formalism[206] regards the formality of law as an implication of legality and the rule of law.[207] Moreover, Paul B. Miller[208] argues that

> "The structural formality of law and deliberatively formalistic legal reasoning are thus the mechanisms through which the law generates and maintains order, even as the relationships between the content of law, responsive deliberative engagement with law, and behavioral manifestations of order are neither fixed nor linear."

The unpredictability of vague standards stimulates actors to look for clearer rules offering predictability in the litigation process. It is argued that legal formalism takes many forms, and Lochner[209] is referred to as a classic example of formalism. Hence, the decision is based upon formal rules defining the disputed matter, and the court's reasoning was formalistic by considering the term "liberty" as self-defining.

It is argued that "formalism" designates the mechanistic application of rules without consideration of their purposes, and so, it could be said that formalism focuses on the separation of law and politics.[210] H. Kislowicz and B. Berger[211] argue that

> "at a general level, formalism is designed to remove at least some measure of discretion from decision-makers…Formalism can inhibit courts from making some of their reasons for decision explicit, damaging the transparency that is essential to structures of legitimacy."

On the other hand, formalism allows the judgment to be grounded in the content of the law, which regulates entirely the disputed matter, thus permitting the elaboration of the legal reasoning.

It is argued that formalism prevents courts from remedying injustices that do not fit the pre-defined categories; on the other hand, courts cannot become regulators by adding new content to a law and so, it is not a matter of formalism but a matter of amending the law by the legislature. Formalism does not mean that we cannot gather evidence in interpreting the formal content of the law, but it means that the judgment is grounded in the formal content of the implied rule and not any other fact outside of the precise content of the rule. Hence, it cannot be said that formalism is getting in the way of principled justice.

It is characteristic that an increase in the citation to nonlegal information in judgments signals a break in acceptable authority, indicating the declined dominance of the traditional role of legal information and, in turn, generating the phenomenon of "delegalization" of law.[212] Does resolving matters of competition law via economic effects analysis lead to "delegalization" of law? Besides, the judgment has to be grounded in the law and not on nonlegal information, which merely can be utilized in interpreting the content of the law. Moreover, formalism stresses the rational deducibility of law.[213] Also, Richard Posner[214] portrayed legal formalism as the theory that "once lawmakers produce rules, judges should apply them to the facts of a case without regard to social interests and public policy." In addition, David Lyons argues that formalism is a manifestation of the competence of law as a means for deciding any case that occurs, and the law is "complete and univocal."[215] It could be said that formalism stresses the role of the judge and the adjudication process as the autonomous way of deciding the one and only outcome of a case, undiluted by nonlegal normative aspects of law or political thinking. In contrast, realism underlined the sociological reliability of a decision.[216]

It has to be taken into account that formalism does not mean applying a "rigidly doctrinaire"[217] type of syllogistic reasoning, causing a misapplication of law principles to generate socially unacceptable results[218] and consequently injustice. Hence, formalism denotes a mindful rule application characterized by implementing normative principles internal to law.[219] It could be said that "doctrinalism" is honored by formalism, involving the core of a judgment and the characteristics of adjudication.[220] In addition, formalism is impartial for the reason that it utilizes legal doctrines, thereby embracing canons and principles choices.[221]

Taking into consideration that lawmakers make the law predictable, Justice Gorsuch[222] specified that it is not legitimate "the judge … to revise the law willy-nilly" which means that judges should refine a law's pre-standing sense. In other words, rules should plainly produce the expected outcomes[223] which means that laws have to be both predictable and restrictive. The rise of legal formalism is correlated with the accomplishment of substantive legal changes such as establishing the supremacy of the right of contract,[224] and so formalism advanced the objective nature of the market by neutralizing and defusing the political and "redistributional" prospective of law, which means that legal formalism's appearance motivated law toward embracing a standard of objectivity which means objective judgment and politically neutral application of legal rules.[225] Likewise, in formalism, Pildes[226] says that law is "an internally valid, autonomous, and self-justifying science" in which right solutions are "derived from the autonomous, logical working out of

the system." In line, Barak Orbach[227] argues that "both rigid formalism that curtails the ability of courts to exercise discretion and informality that leaves courts with unguided discretion tend to lead to arbitrary outcomes and cannot persistently serve society."

Formalism does not mean that the formal terms of law are interpreted in a totally strict way, but there is a need to encompass the entire spectrum of matters included in the understanding of the term, as long as the matters are defined under formal rules and are not being merely social stories, economic facts, or political ambitions. Therefore, if there are new developments due to technology, social, and economic advancements, the new understanding will be considered part of the content of formal law. It is argued that rules and standards tend to represent degrees of discretion, not types of legal norms.[228] On the other hand, legal norms are encompassed in formal rules, but the interpretation includes degrees of discretion in identifying the settings for the implementation of the norms in the specific environment and field. It is characteristic that formalism is utilized in defining the categories of per se liability.[229]

American antitrust law today is categorically rooted in economics. In this context, J. Schmitten[230] argues that "the realities of statute-based law are such that antitrust law may always contain residual, economically unjustified legal formalities." On the other hand, formal law cannot avoid formalities, but the exact definition of the factors defining the regulated matter adds to legal certainty and predictability, which means justified economic approach as long as competition rules are formalistic and not based on vague economic factors. This leads to chaotic and divergent approaches concerning the definition of the goal and the implementation of the task of competition law, which has to be strictly defined and not left under vague terms such as protecting the economy, but formal definition of a precise task such as facilitating an open market for all candidates to operate under equal opportunities and defining the exact legal terms of the competition process under which the goal is fulfilled.

By setting as the goal of competition law the growth of an economy or the good of consumers, it denotes the wish to have an unidentified goal in order to allow many views for promoting competition and countless economic facts contributing to divergent judgments. This enables capital to operate freely in a free way of achieving its expansion without any cost or order. It seems that the prevalence of an increasingly economics-based antitrust jurisprudence over statutorily imposed formalistic rules has led to a divergence in defining which actions are pro-competitive and which are anticompetitive. This has allowed the emergence of monopolies and oligopolies in many fields, not mentioning the inability to apply the same economic terminology and analysis to digital corporations and the functioning of the digital economy and the forthcoming AI economy has resulted in an unregulated digital economy untouched by competition and competition law and enforcement.

Taking into account that competition and the goal of competition law are supposed not to be altered since its appearance, it seems that from a formalistic rule in the Yellow Cab,[231] the court is moved to Copperweld's[232] anti-formalistic approach, denoting the legal uncertainty and predictability regarding competition law and enforcement.[233]

It has to be taken into account that the distinction between horizontal and vertical restraints is formalistic, energizing a dogmatic distinction between vertical and horizontal restraints, which means standardization of the concept and, thus, bringing legal certainty to competition. Also, antitrust formalism offers the structure for antitrust analysis and is significantly vital. Nonetheless, the device is often abused by forcing presumptions and rules to their extremes, and so, there is no need for a strictly rigid interpretation but one enclosing a precisely defined reality.

It is worth mentioning here that informality and formalism are not separate approaches, but noticeably they are two ends of a scale which means that some formalism is necessitated to structure a meaningful decision-making process and that exclusion of sources of information can harm the quality of the decision-making. Therefore, the actual selection is of the degree of formalism.

What is the relation of formalism and functionalism? Formalism is characterized by categorical rules, deductive reasoning, and an aspiration toward predictability[234] and thus formalism is the court's preferred methodology in bankruptcy cases. In contrast, functionalism is marked by fact-intensive rules, inductive reasoning, and an aspiration toward efficiency[235] and so, in preferring formalism, the court has underestimated functionalism.

Formalism values "transparency, predictability, and continuity," whereas functionalism respects "adaptability, efficacy, and justice in law." Moreover, formalism mainly supports "deduction from authoritative constitutional text," while functionalism upholds "induction from constitutional policy and practice."[236] Formalists deem that final judgment and enforcement must come from Article III court.[237] Chief Justice Roberts suggested that formalism is the only way to achieve the promise of Article III.[238]

It could be said that functionalism highlights the values of market freedom and competition, which are jeopardized by state intervention. Hence, formalist law has to be functional with the purpose of surviving challenges arising from societal diversity, political controversy, and economic growth. Functionalism is an appropriate formula for law's capability to survive, primarily by remaining adjustable and responsive. In line with this, B. Srbinovski[239] argues that

> "functionalism has a stronger pedigree and is better suited to the scale and variability of the issues that come before modern courts in mass tort cases. A functional approach is not only better aligned with the substantive goals of bankruptcy, but also deeply embedded in the traditions of the practice of bankruptcy law."

Furthermore, functionalism in law illustrates the manner in which the flexibilization and modernization of formal law, in response to a gradually multiplex social environment made up of competing interests and contestations, occurs if law is to preserve a steering role. In other words, good formal law is functional.

Do judges decide outside the law according to functionalism? Judges have to decide according to the wording of a rule, taking into account the perception of the disputed matter that prevails in commerce or the social sphere. Can courts ignore

the formal law of the disputed matter and decide based on a practical approach? Courts have to apply the relevant formal law, otherwise any decision grounded in practice and not conforming to the formal law will be annulled.

Finally, it could be said that new technologies brought forth the demand for Neo-formalism, denoting a rationale that a principle has to be interpreted in such a way that substantial furtherance of the precise statutory or constitutional prescription must be endorsed in order to cover all the possible occasions fitting within the wording of the principle. Additionally, the AAI Neo-formalism will express the rationale of Neo-formalism and will be operated by AAI humanoids in an AAI economy where objectivity will be exploited in order for the whole AAI system to function properly, illustrating the new spirit of running applications because otherwise the same cons/pathologies of the conventional system will emerge.

It has to be taken into account that consciousness is the root of biological intelligence, but the development of AI reveals that intelligence can exist without consciousness. On the other hand, humans have entered a new era by making current robots to extend human intelligence, but the forthcoming AAI humanoids will be able to engage in all human biological and social activities, shaping the AAI society. Even current technology robots are anticipated to replace or even outstrip human intellectual work with competence and accuracy. Are humans expecting robots to have the same humans consciousness? Of course, AAI humanoids will have the consciousness suitable for allowing them to function properly in an AAI world and probably in both material and spiritual dimensions. Furthermore, when AAI humanoids have self-awareness, communicating directly like humans and developing collective values, then they will represent human "heterogeneity."

Will humans generate a new type of life via AAI technology? Currently, AI is utilized by humans as a tool in advancing human capabilities in the whole sphere of life. With the forthcoming AAI technology and the appearance of AAI humanoids with capacities beyond humans, the AAI judge will interpret the law according to its wording, covering all possible occasions and taking into account of course general economic principles that elaborate on the general wording of competition law. Thus, according to the formalistic approach, AAI technology will categorize the occasions regulated by AAI competition law rules.

4.6 Finance and Competition

It has to be taken into account that the spread of FinTech brings both opportunities and challenges to the financial services industry. On the one hand, augmented FinTech activities stimulate greater competition and diversity in lending, payments, trading, and other financial services, leading to broader financial inclusion and a multiplied customer base resulting in enhanced revenue streams, upgraded efficiency, and enriched resilience in the banking system. On the other hand, heightened competition puts pressure on the profitability of conventional financial institutions (FIs) taking on extra risks to maintain their margins. To that extent, Selim Elekdag[240] et al. argue that

> "higher capital and liquidity ratios as well as greater income diversification can reduce the influence of growth FinTech activities on risk taking across FIs. Likewise, there is suggestive evidence indicating that in some cases greater FinTech presence may be associated with less FI risk taking amid stronger institutions."

The banking industry is experiencing a digital revolution, and so, by sensing pressure, FinTech corporations and BigTech platforms are endorsing AI technology in traditional banking businesses.[241] Hence, the digital revolution has had significant consequences for banking, and so, digital banking platforms, encompassing mobile applications and websites, have become prevalent. Thus, digital AI technology serves as an alternative to brick-and-mortar branch networks, becoming the leading means through which consumers access and banks provide financial services.[242] Thus, the digital revolution concerns how banks compete, and competition in banking is of particular interest as a result of its inferences on financial stability, influencing the whole economy. Digital banking alters both the size distribution of banks and the composition of services they deliver. To that extent, Naz Koont[243] argues that "digital platforms have increased competition in deposit and loan markets by allowing mid-sized banks—those with relatively high-quality digital platforms but without extensive branch networks—to gain market share through higher demand and lower costs."

Digital banks strengthen their share of uninsured deposits while downgrading their share of loan originations to low-income borrowers, somewhat driven by a lower capability to digitally screen or monitor this market segment. Thus, digitalization modifies the likelihood of bank distress by increasing funding instability as measured by banks' share of uninsured deposits, and by leading to raised credit risks in market segments that are less well supplied by digital technologies. Additionally, digital banks face higher deposit outflows for each deposit market segment in response to increases in interest rates, leading to a lower deposit value for a given level and composition of deposits.[244] Hence, the increase in size and geographic reach of mid-sized banks makes them more significant from a financial stability point of view. Moreover, concentration, market integration, and markups augment competition in banking.

It is worth noting that the digitalization of banking has consequences for monetary policy because the spread of digital banking modifies banks' capability to screen or monitor customers across different market segments, elevating risks in market segments that are less well served via digital technologies. To that extent, Naz Koont[245] argues that

> "digital banks attract a different and potentially flightier deposit base. The 2023 banking crisis highlights the dangers of a deposit base that is mostly comprised of uninsured deposits…digital banking also reduces the variable costs of deposit provision… digital banks also face higher deposit outflows for each deposit market segment in response to increases in interest rates, leading to a lower deposit franchise value for a given level and composition of deposits."

Increased competition among banks leads to heightened financial instability as intensified competition erodes market power, diminishes profit margins, and damages value. Thus, banks face greater enticements to engage in excessive risk-taking.[246] It is argued that greater competition not only augments bank fragility but does so to a greater extent as activity constraints become more stringent. Hence, in banking markets characterized by amplified competition, banks typically maintain lower capital buffers, and the competition has a negative effect on banks" risk attitudes.[247] Moreover, competition boosts financial stability by lowering loan rates, diminishing borrower credit risk, and reducing the possibility of bank failures.[248] It must be taken into account that lower entry barriers boost lending and growth, but also risk-taking.[249] Competition reduces the overall riskiness of bank lending, stimulating lower interest rates and, thus, moderating moral hazard concerns of bank borrowers.[250] Due to the existence of information barriers in global trade along with the digital revolution, Xuanyi Shi[251] et al. argue that "banks with foreign investors tend to create less liquidity, especially in on-balance sheet liquidity creation activities."

It is characteristic that global trade has been affected by military conflicts, political pressures, and trade wars; thus, the global supply chain is facing restructuring tension. To that extent, Xuejing Yang[252] et al. argue that "In this political current, the US government is increasingly moving toward local protectionism. Another outcome of the trade war is the shift in the world's personal value orientation brought about by the change in political winds."

Financial institutions are not immune from antitrust laws; therefore, competition policy is part of federal bank regulation, overseen by the specialized regulatory agencies. US banking law ascertains competition policy in banking through regulatory review of bank mergers and acquisitions, anti-tying rules, and prohibitions on management interlocks. Thus, this mode signifies the direct, or formal, application of antitrust to banking institutions.[253] The power of banks stems from the aggregate control of banks over credit.[254]

Upholding the applicability of the Sherman and Clayton Acts to commercial banking, the Court recognized that bank regulation sought to "minimize the hazards of intense competition."[255] Anti-tying in banking law restricts a practice viewed as anticompetitive in most business contexts and so, in the US, the Clayton Act outlaws tying arrangements that "substantially lessen competition or tend to create a monopoly in any line of commerce." In the banking context, this policy apprehension is vital owing to banks" legal monopoly on money creation.[256]

The banking sector is adopting information technology and Big Data in response to the increased supply of technology and to alterations in consumer expectations of service being drivers of digital disruption.[257] Information technology allows financial intermediaries to advance personalized services. Additionally, risks are triggered by the privatization of big data, and it seems that privacy laws are unsatisfactorily protective of peoples" data when private technology corporations collect it.[258]

Banks and fintech corporations channel almost all payments between agencies and the public via different programs and, consequently, progressively collect

more data while doing so.[259] To that extent, the digitalization process is promoting remote loan operations. Additionally, centralized digital infrastructures are vulnerable to software updates superseding original safeguards.

A bank's IT progress augments its competitive advantage. If IT progress involves only a drop in the costs of supervising an entrepreneur without shifting banks" relative cost advantage, then banks" competition force will not be affected by such technological progress. Moreover, when competition in the lending market is at a low point, intensifying competitive intensity enhances welfare because more competition boosts entrepreneurs" utility. On the one hand, expanding competition power assists entrepreneurs; on the other hand, more competition lessens banks" profits.[260]

4.7 Formalism in Financial Competition

It is characteristic that the Supreme Court applied antitrust rules by reference to effects on "competition" as such.[261] Hence, antitrust should turn away from the welfare and efficiency tests that have conquered antitrust law, returning to the protection of competition and the competitive process, which means that antitrust rules have to assess whether some behavior advances or hinders "competition."

Taking into account that the antitrust statutes are broad and generalized, courts have formed a system of doctrine in implementing the prohibition on restraint of trade in Section 1 of the Sherman Act, the prohibition on monopolization[262] in Section 2 of the Sherman Act, and the prohibition on certain mergers and acquisitions in Section 7 of the Clayton Act, which encompasses court-created rules relying on an unliquidated "competition" criterion.[263] It is worth noting that Senator Sherman proposed the prohibition of agreements "which tend to prevent full and free competition," which has to be seen as the spirit of the legislature regarding competition.

Per se illegality applies to practices that are openly or clearly "anticompetitive," and operative legal rules rest on whether some practice or transaction damages or promotes competition. Jonathan Kanter[264] has suggested that courts embrace a merger test based on whether the "competitive process" has been damaged, rather than on any assessment of outcome consequences, which means that there is a need to concentrate on competition as an administrable standard rather than on quantifying consumer welfare results. The competitive process should be operationalized in legal doctrine in a formalistic way, leaving room for interpretation under other formal rules covering competition in order to achieve a standardized understanding of the actions boosting competition and, thus, defining the anticompetitive contacts. In line with this, Greg Werden[265] claims that the Supreme Court's rule of reason decisions "exhibit a single-minded focus on the competitive process," and that "impact on competition" transpires as the "single criterion for evaluation [of] the legality of a trade restraint," and so, there is reliance on an unliquidated harm to competition test.

It is argued that "competition" should be approached not via law but economics due to the fact that many antitrust concepts such as monopoly, substitutability,

and so on are borrowed from economics, and so the evaluation is determinedly "welfarist."[266] Competition law regulates various matters such as fair competition, which have economic outcomes, but law doctrines govern the disputed matters, and so economic rules should not be considered as the legal rules governing these matters.

It is characteristic that the Court used "competition" broadly, describing market interactions free from antitrust violations and prohibiting actions such as abolishing the chance of buyers and sellers to contract on the basis of fair, open, free competition.[267] Thus, courts often imply that whatever advances overall welfare is procompetitive, while whatever diminishes it is anticompetitive.[268]

It is worth mentioning here that the Supreme Court has denied that the competition criterion can be focused on welfare results, since a transaction can harm competition even if its effect on welfare is positive[269] which means that feasible economies cannot be utilized as a cover for illegality. Moreover, the Court has underlined that welfare harm does not verify harm to competition and so neither the charging of monopoly prices nor cutting off a rival was considered "anticompetitive."[270] From case analysis, it emerges that the "competition" criterion is grounded in a multipart and inconsistent relationship with a whole display of rather different values. Hence, antitrust should maximize and optimize fair competition in the market via legal doctrines encompassing standardized economic rationales. To that extent, Steven C. Salop[271] argues that "while antitrust law in principle can evolve, new legislation would be a more rapid—and more certain—path to reform."

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5 Financial Crimes

5.1 Market Abuse in EU

Market integrity entails obligations and duties be imposed on all players, such as issuers, investors, brokers, and others who make investment recommendations or compile statistics, and even on the market itself and its infrastructures. Thus, a market characterized by integrity is a market whose characteristics are close to those assumed in the theoretical model of a "perfect market" and so, such markets do not unexpectedly arise from the pursuit of their participants, but rather from the intervention of lawmakers. Besides, weakening of market integrity is not specific to market abuse conduct and so does not serve to mark market abuse infringements from other actions undermining market integrity.

Market abuse involves a number of different conducts clustered into two main categories: (1) insider trading[1] by utilizing inside information with the purpose of making, altering, or terminating deals, or to push a third party to deal using this knowledge and unlawful disclosure of inside information, by releasing information without correct permissions; (2) market manipulation, split into trade-based manipulation, action trade manipulation, or information-based manipulation which distorts market performance. Additionally, in EU law, market abuse is defined as any prohibited conduct on the financial markets implicating the commission or attempted commission of insider trading by the unauthorized disclosure of inside information or the recommendation to others to engage in insider trading, along with market manipulation. In other words, market abuse prevents full and effective market integrity and so compromising public confidence. It is argued that insider trading regulation ensures market fairness and investor confidence and, therefore, safeguards market efficiency, which means that insider trading is a form of market abuse.[2]

Unlike insider trading, market manipulation is a very broad category of conduct extending beyond securities to other markets such as commodities, foreign exchange, and energy resulting in both public and private actions. Commonly, trade-based market manipulation incorporates offenses such as market manipulation, market/price rigging, and false trading. It is argued that the concept of market manipulation should be abandoned altogether due to the fact that "fictitious trades should be analysed as a species of fraud," while real trades should not be banned as manipulative notwithstanding the intent of the trader.[3] Furthermore, in the United

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States, insider trading is both a crime, which can be punished by monetary penalties and imprisonment, and also a civil offense. The public players also have capabilities that could be classified as administrative. Largely, private enforcement plays an inferior role only.[4] It has to be taken into account that a Suspicious Activity Report (SAR) must be filed when an employee or individual believes that a customer may be implicated in suspicious transactions.

It has to be taken into account that one of the demanding issues caused by the prohibition of market abuse (insider trading, unlawful disclosure of inside information, and market manipulation) is to discover the reasons or grounds that validate the prohibition. To that extent, the Market Abuse Regulation (MAR[5]) and Market Abuse Directive (MAD[6]) state that their objectives are to make certain the integrity of securities markets and augment investor protection and confidence in those markets; but they do not verify the meaning or scope of those aims. Moreover, the Market Abuse Regulation (MAR) is directly applicable in the Member States, setting out a uniform framework prohibiting market abuse throughout the EU, with the aim of avoiding significant distortions of competition and regulatory arbitrage. Besides, the Directive (MAD), faced with the demonstrated inadequacy of the administrative sanctions for ensuring a strong sanctioning regime for market abuse conduct throughout the Union, opts for strengthening the administrative sanctions outlined in the MAR with criminal sanctions, which the Directive proclaims will have an added deterrent result making certain compliance with the rules on preventing and fighting market abuse.

Manipulative conducts via release of false or misleading information about the issuer in the market, carrying out trades that fix artificial price levels, result in prices not accurate and not representing the genuine value of the traded financial instruments and consequently are not fair. The lack of integrity in this case is demonstrated by interference in or disturbance of the free formation of prices in the market as a result of the play of supply and demand.

The use of inside information has produced greater controversy. There is no consensus as to what establishes lack of integrity in the conduct of an insider trader and what particular objective is pursued by the prohibition. It has to be considered that two different things are mixed together: the protected legal interest and the ratio legis. The absence of integrity or the unfairness of engaging, with full awareness, in transactions on the basis of inside information rests in trading in possession of a central part for making investment decisions that the rest of the actors do not have, namely, information that influences prices. Moreover, trading in securities markets is done on the basis of price-sensitive information that is legally available to all; thus, anyone who owns an informational privilege not available to the rest cannot trade in the market. The lack of integrity or the unfairness of insider trading is conspicuous in a system that forces issuers to publicly disclose the inside information as soon as possible so that it is equally accessible to all players (Art. 17 MAR), which means that this obligation of swift and adequate disclosure boosts investor confidence that prices reflect all existing information; thus, trading by an insider results in a double cheating of investor prospects: first, for the reason that prices do not reflect all of the information due to the fact that the inside information

has not yet been priced in; and, second, for the reason that there are some parties such as those closest to the issuer who utilize their informational advantage.

EU law refers to the subsequent and eventual purposes pursued by the prohibition in the preamble and in the articles of the MAR and MAD, which assert that the prohibition augments investor confidence, an indispensable prerequisite for securities markets to perform properly and accomplish the functions entrusted to them, such as facilitating economic growth and job creation. Moreover, the final objective of the prohibition, or *ratio legis,* plays a much more limited role than the immediately protected legal interest but nonetheless facilitates knowledge of the unlawful conduct's repercussions and the justification of the incrimination, etc. Furthermore, with the prohibition of market abuse, lawmakers guarantee the fairness and integrity of markets, and by protecting integrity and fairness in markets, they are pursuing other objectives that are regarded as worthy of protection: enriching investor confidence in securities markets, understood to mean the clear anticipation of investors that there are fair rules of play that are valued by all. Likewise, the prohibition of market abuse is a tool for accomplishing market integrity linked to propriety in the formation of prices and to trading based on price-sensitive information that is accessible to all and that market integrity, sequentially, is a device for boosting investor confidence in markets.

The majority of the provisions in the European Union's Market Abuse Regulation (MAR) apply from 3 July 2016,[7] and so, the MAR offers a number of administrative sanctions and other measures that can be applied to insider trading. The EU has also published a Directive relating to market abuse, the Directive on criminal sanctions for market abuse (CSMAD).[8] In essence, the Union legislature started to rely strongly on criminal law enforcement with the Directive on criminal sanctions for market abuse 2014/57 of June 12, 2014, stipulating now in Article 7 that the MS have to make certain that insider trading is punishable by a maximum term of imprisonment of at least four years and demanding administrative pecuniary sanctions.

Consequently, the Market Abuse Regulation brings convergence by introducing a common European framework seeking to prevent, detect, investigate, and sanction both insider dealing and market manipulation.[9] Moreover, the Market Abuse Regulation makes available a common framework for the revelation of information and powers, as well as obligations for the enforcement of the regulation, to be vested in a single knowledgeable authority in each member state. To that extent, the Market Abuse Regulation applies to any financial instrument admitted to trading or where an appeal for admission to trading has been made on a regulated market in at least one member state. The Commission wants to protect investors against market abuse, in principle irrespective of the type of market. The Regulation also expands supervisory and enforcement possibilities for regulators. One of the more considerable proposed modifications is the provision of access to private premises and telephone and data traffic records from telecom operators.[10] For the reason that private enforcement is not openly addressed at the EU level, in contrast with the case of competition policy, it will be up to the national courts of the member states to establish the terms and conditions of such private enforcement. Moreover, the

Directive boosts the administrative law dimension, which, according to its recital 5, has "proven to be insufficient to ensure compliance with the rules on preventing and fighting market abuse." Today there is a coexistence of both types of sanctions, and so member states may extend their enforcement provisions also to private enforcement or maintain private enforcement systems that they have in place.

It has to be taken into consideration that insider trading and market manipulation corrode confidence in markets and, thus, restrictions on market manipulation lower sophisticated professional investors' and analysts' costs of substantiating the credibility of information, augmenting their capacity to make truthful predictions, while restrictions on insider trading protect investors and analysts from competition with insiders. Even when the corporation is not itself a purchaser or seller, it still owes a duty of faithfulness in any communication affecting the investing public, thereby enlarging the range of the prohibition to embrace all corporate communications on which investors are expected to rely. Furthermore, insider trading and market manipulation have been distinguished as resulting in a form of "public cost" in the perception that they extinguish trust in market fairness and efficacy, signifying a market failure if they are predominant.[11] In other words, enforcement of securities laws, including insider trading and market manipulation laws, plays an imperative role in deterring misconduct.[12] Bromberg[13] et al. argue that

> "even in jurisdictions with very similar legislation on insider trading, such as Australia and Singapore, different sanctions are used to enforce these laws, which may be a result of the different enforcement budgets, enforcement priorities and strategies of regulators, prosecutors and other decision-making bodies."

5.2 AI Algorithmic Trading and Manipulation

It has to be taken into consideration that greater datasets are a key input for corporations in creating or utilizing artificial intelligence (AI) systems, but AI algorithms are unworkable without a large dataset. Moreover, the development and commercialization of AI-related products and services cause greater productivity growth, but nonexistent competition from startups and other entrants means that the economy fails to generate productivity growth.

Taking into account that AI algorithmic trading exposes markets to new and emerging risks, embracing novel types of market manipulation, every time market manipulation goes undetected is left unprosecuted, it eventually jeopardizes market safety and integrity, which means damaging investor protections and confidence to the point of putting the stability of the global financial system at risk.[14] Moreover, AI trading can lead to a number of unintentional results, involving optimized forms of market manipulation that undermine capital markets' stability and integrity. On the one hand, the use of AI makes certain that corporations utilize their resources and make decisions under conditions of uncertainty in a more operationally effective way. On the other hand, the competitive superiority presented by AI develops

into more favorable market conditions and augmented allocative efficiency for consumers, investors, and society.

AI algorithmic trading indicates technologically enabled methods of financial trading leveraging the use of computer algorithms to fully automate tasks within the trading cycle. Moreover, AI algorithmic trading applies to several tasks, such as pre-trade analytics, trading strategy selection, order routing, and execution management, as well as post-trade analytics.[15] Hence, AI trading not only enhances old-fashioned manipulative strategies by making their economic performance faster, cheaper, and more secure but also, due to AI greater analytical power and improved connectivity leads to new and more complex forms of manipulation.[16]

It has to be taken into account that AI fulfills the purpose of malicious players looking for tactics to optimize their manipulative algorithmic strategies to the impairment of other market participants. Nonetheless, AI trading malfunctions autonomously in a rational manner, notwithstanding human intent and even negligence, while pursuing its pre-set trading objectives. Hence, AI methods optimize some algorithmic and predominantly high-frequency trading (HFT) forms of manipulation, which means that AI trading can boost and execute forms of "cross-asset" and "cross-market" manipulation. Moreover, AI trading leads to new and more high-tech types of manipulation by combining factors of different strategies.[17]

Will AI eliminate human misconduct and crimes? The current AI technology managed by humans means that management will implement human activities subjectively and not objectively due to human programming, but the detection might become more obscure owing to the character of AI systems. On the other hand, AAI technology functioning objectively will detect and implement AI trading, unless its functioning is not objective and merely AI becomes a more advanced device in the hands of any elite.

It has to be taken into account that competing trading algorithms could lead to the appearance of cartel-like behaviors in a novel way, and so, delegating decision-making tasks to AI agents paves the way for "tacit" forms of collusion. Principally, competing algorithms achieve suboptimal market equilibria without any demand for communication by merely relying on their superior analytical capabilities, which means that AI forms of collusion can take place whenever certain conducive market factors for algorithmic forms of collusion to emerge are present. Additionally, taking into consideration AI's greater analytical capabilities, speed of action, and market ubiquity, certain AI modes of algorithmic trading rework the traditional contours of manipulation, which means that AI can facilitate easier and profitable manipulative strategies, which were previously thought hard to accomplish, without facing significant risks of being detected and punished.

It is worth noting that algorithmic forms of manipulation, such as "trade-based" and "order-based" manipulation, are covered by the legal definitions given by the EU MAR. Article 12 MAR specifies a list of trading actions and behaviors that the EU legislator rules out and, by its enforcement, punishes as being harmful to the integrity of EU capital markets. The EU MAR/MAD legal framework specifies a "dual-track" system of liability for market manipulation, and so, violations

of market conduct rules can either give rise to administrative or criminal liability resting on the significance of offenses evaluated on a case-by-case by supervisors.

Also, it has to be taken into consideration that the diverse legal treatments by Member States' legal systems of the prohibition of market manipulation do not lead to a level playing field across the EU by subjecting EU capital markets to risks of "regulatory arbitrage" leading to ineffective enforcement against most cutting-edge and cross-border instances of manipulation led by AI. On the other hand, AI's objective implementation demands standardization of context and enforcement concerning market manipulation, not mentioning that AAI trading via AAI humanoids' activity has to be standardized concerning the reality of AAI market manipulation, which will be detected by advanced AAI systems functioning automatically and autonomously.

It could be said that AI trading left functioning in a lawless market environment to manipulate regulatory arbitrage opportunities presented by the current EU antimanipulation law and its enforcement, leading to "forum-shopping" possibilities for AI traders.[18] In addition, the undefined equivalence of administrative and criminal sanctions exposes EU capital markets to enforcement inconsistencies to the extent that criminal sanctions substitute administrative ones since criminal law enforcers lack some instruments that MAR defines as minimum administrative powers. In reality, "cross-market" supervision of EU markets has not been successfully implemented, something that could be, in principle, assigned to NCAs. Thus, a central AI system is needed in order to harmonize enforcement, which demands EU become a single entity in the form of USE[19] in order not to have discrepancies due to the differences in national laws.

It is worth noting here that monopoly and oligopoly in AI not only alter markets and freeze investment impeding innovation but also enable downstream damages to users by permitting the buildup of monopoly private power.[20] It is characteristic that the market for AI applications is flourishing, but, on the other hand, an oligopoly of players runs the new AI technologies on which new technology applications are based. T. N. Narechania and G. Sitaraman[21] argue that "an unregulated AI oligopoly has undesirable economic, national security, social, and political consequences."

5.3 Market Manipulation in NFT Markets

Non-Fungible Tokens (NFTs) are digital assets that utilize blockchain technology for fundraising. The NFT market gained significant attention, and essentially NFTs are a form of equity crowdfunding in an unregulated environment. Moreover, NFT creators raise funds for their projects by selling their NFT collections to initial investors in the primary market.

It is worth noting that closed-loop woken trades, closed-loop value trades, and large transaction volumes are tactics employed in the NFT market encompassing suspicious trading activities.[22] Moreover, insider trading, wash trading, and price manipulation[23] are utilized in the NFT market.[24] In fact, blockchain technology

diminishes information asymmetry by stimulating transparency and, thus, averting speculation in NFT marketplaces.[25]

It has to be taken into consideration that there are two ways that concealed insider trading and wash trading influence the market. First, secret insiders may use their information on the NFT collection earlier than other investors since they interact directly with NFT creators. Nonetheless, they may not be able to utilize their information successfully, given that they already hold an illiquid membership ticket. Second, while NFT wash traders intend to draw investor attention by overstating trading volume and price, the value of such strategies is uncertain because the NFT community energetically reveals wash trades. Sebeom Oh[26] argues that

> "insider buying activity is a strong predictor of future daily price index returns. A one standard deviation increases in insider buying activity leads to around a two-percentage point increase in future daily median price returns. While wash trading exhibits a negative effect on future price returns, the impact is economically negligible."

Also, more information access is destructive when speculative motives overshadow the market, and so, the blockchain technology secures a high level of information access.

It is worth noting that insiders take advantage of information asymmetry in NFT markets, and wash trading is, in reality, unproductive in manipulating market outcomes. Hence, investors do wash trades to produce artificial financial rewards or attract market attention to startup marketplaces in order to participate in the dominant marketplace. On the other hand, blockchain technology is utilized to reveal insider and manipulative trading in recent crypto assets, thus heightening data governance and transparency in financial markets. Moreover, efforts should be made to augment transparency in the NFT market, predominantly relating to insider trading practices. In fact, crypto technologies have penetrated the development by opening up new frontiers of crypto-capitalist expansion and experimentation globally, which means that crypto investors have taken strategic advantage of weak regulatory environments, social vulnerability, and the appeal for techno-economic modernization in many states to expand crypto interests.[27]

Manipulation is often linked with high-frequency and deceptive trading activities, known as spoofing, which do not cause ownership alterations. Likewise, NFT creators and insiders take part in wash trading because it produces fake abnormal liquidity and an unusually high price attracting investors. Thus, NFTs denote a new method of crowdfunding accelerated by blockchain technology. To that extent, Sebeom Oh[28] argues that

> "insiders' buying activities strongly predict future daily price index returns. However, wash trading is economically insignificant. Moreover, insider purchases and wash trades do not significantly affect future changes in trading volume. This suggests that unreported insiders take an advantage of information asymmetry in NFT markets but wash trade is actually ineffective to manipulate market outcomes."

It is worth mentioning here that non-fungible tokens (NFTs) became a global means of the financial market tendering a disruptive vision to the art and collectibles market. Moreover, the assets represented by NFTs are exchanged in special marketplaces, initiating a tokenization[29] from reality to digital, which means that NFTs are utilized to produce verifiable digital ownership over several assets encompassing crypto art, digital collectibles, online games, intellectual property rights, real estate, and financial documents, denoting their flexibility as a crypto asset and their disruptive potential in numerous markets. Hence, innovative mechanisms approximating NFTs are conceivable as a result of the advent of DeFi. On the one hand, NFTs produce wealth by aiding artists, collectors, and interested parties in negotiating in a secure and decentralized environment. On the other hand, alarms linked to Anti-Money Laundering (AML) and Counter-Terrorism Financing (CTF) arise owing to the current regulation on crypto assets and the anonymity presented by DLT. Additionally, market contributors implicated in trading NFTs face potentially high costs for noncompliance if the legislation is not clear enough about the legal status of NFTs.

The key innovation of NFTs compared with traditional crypto assets is their non-fungibility; thus, NFTs are unique, non-interchangeable tokens. Moreover, like crypto assets, NFTs are pseudonymous, global, and immaterial, and so like fine art, they have a decidedly subjective price.[30]

5.4 Insider Trading on the Blockchain and Beyond

It is worth mentioning here that insider trading is a trade-off between upgraded price accuracy and decreased liquidity from market participants.

First of all, the Howey test is still used by the SEC today and holds that investment contracts are securities if they involve an (1) investment of money, (2) in a common enterprise, (3) with a reasonable expectation of profits, (4) derived from the efforts of others. Courts have interpreted the Howey test to cover most stocks and bonds plus linked instruments and assets.[31] On the other hand, crypto assets are essentially different from stocks and bonds in several significant ways since cryptocurrencies have numerous functions for different owners, acting as a means of payment, a speculative investment, or a method of fundraising. Also, in crypto industry, there are dangerous information asymmetries that traders exploit at the expense of others. Ester Félez-Viñas et al.[32] argue that "insider trading might be even more prevalent in crypto markets than in stocks, where insider trading is estimated to occur between 5-20% of merger announcements." The SEC has supported that XRP tokens are investment contracts subject to SEC regulation.[33]

SDNY[34] alleged that the employee, Nathan Chastain, had committed insider trading in the NFT market by using confidential, nonpublic information that he had obtained while working as a product manager at OpenSea. Moreover, SDNY[35] charged three individuals for engaging in a similar insider trading scheme involving the cryptocurrency exchange Coinbase. In the end, neither Chastain nor Wahi and his co-conspirators were actually charged with insider trading because to charge an individual with insider trading, the asset being bought or sold must be a security.[36]

In line, Anand Balaji[37] argues that "Crypto assets are a new technology which have experienced serious threats from insider traders. However, because it is difficult to classify cryptos easily and consistently as securities, the blockchain has generally been off limits to classical insider trading prosecutions."

It has to be taken into account that criminalizing insider trading in non-securities markets is an expansion of criminal liability resting on expanding the federal wire fraud statute. It has to be taken into account that the first "insider trading" conviction grounded in trading in NFTs, the prosecution relied on wire fraud rather than securities fraud by accepting that Chastain had misappropriated OpenSea's property comprised of confidential business information about NFTs that would be featured on OpenSea's homepage and thus circumventing to define if the NFTs are securities. It is characteristic that Judge Furman[38] stated that unlike 10(b), the text of the wire fraud statute makes no reference to securities or commodities, explaining that confidential business information qualifies as property and does not have to have some "inherent economic value" to OpenSea.[39] Hence, while the economic value of the misappropriated information was admissible for the reason that it is "relevant in evaluating whether the information is property," the Government did not need to prove that the information was valuable as part of its case.

Due to the fact that OpenSea employees were required to keep NFTs' information confidential[40] and use it only for the benefit of OpenSea, Chastain defrauded OpenSea of its property by exploiting his advanced knowledge of what NFTs would be featured on OpenSea's homepage for his personal financial benefit. Moreover, in order to hide the fraud, purchases and sales are made by using anonymous digital-currency wallets and anonymous accounts on OpenSea.[41] Thus, corporations should implement insider trading policies to prevent digital asset fraud, irrespective of how digital assets are classified.

5.5 Big Data and Insider Trading

It is characteristic that the financial world is gradually advancing into a digital domain of high-volume information and high-speed data transformation and processing. AI automation and ML efficiency are the central technological means to harness the information power from big data pools concentrated in servers of financial institutions and corporations. The recent advances in AI and ML generate a paradigm shift in every sector of the tech industry owing to their capability to handle high-dimensional data sets, which is a fundamental element of the digital transformation of financial services.[42]

Traders illegally misusing inside information cover their trades to escape regulatory scrutiny and, taking into account the difficulty of detecting informed trading using traditional measures, it is challenging to detect insider trading in the AI era. Nonetheless, the employment of novel, nonstandard data together with advancing technology has the potential to fundamentally transform financial regulation. Chinese law specifies that trading with undisclosed insider information is illegal, and so, any undisclosed information "relevant to the firm's operation and financial

affairs" or "that can have a major effect on the firm's market price" is deemed inside information under Chinese law.[43]

It is characteristic that illegal insider trading takes place close to vital corporate events stimulating a suspension period, including M&As, nonpublic offerings, major contracts, and so on. Moreover, insider trading investors are trading in larger amounts than an individual investor's trading history and strengthening positions long before the event announcement, making purchases repeatedly and aggressively, setting up a new account exclusively for trading with inside information. Piero Mazzarisi et al.[44] argue that

> "identification of insider trading is a complicated activity which requires the analysis of large and complex datasets, especially if one wants to consider the activity of potential insiders, not on an individual basis, but through a comparison with the behavior of the whole population of investors."

Additionally, Christian T. Lundblad et al.[45] find

> "that the trading patterns of selected suspicious insiders exhibit similarities with the changes in a firm's central decisionmakers. We also find that insiders are more likely to use multiple accounts to trade around a major information event; we observe this via the IP address attached to each transaction."

To that extent, the EU's Digital Markets Act aims at reducing exclusive control of data collected by digital platforms.

Taking into account that cryptocurrencies are distinguished by the rapid speed of transactions and that the detection of illicit activities may be obstructed, K. Siji-Fasole[46] argues that

> "The increased use of artificial intelligence (AI) and other technology by financial institutions to carry out transaction monitoring through data analysis etc. nevertheless, helps financial institutions to deal with remediation in real time. Adaptability to technology advancement through upskilling is therefore crucial for compliance teams."

Anyway, the law is protecting the general public from abuse in the use of automated technology in the processing of data.[47]

5.6 Digital Currencies and Insider Trading

As economies developed, more standardized forms of currency were introduced to simplify trade and diminish the risk of counterfeiting. Nowadays, most currencies around the globe are fiat currencies, backed by the government's promise to honor the value of the currency. Currency, also known as money, is a medium of exchange used in economic transactions. Cryptocurrency, also known as digital or virtual currency, is a type of currency that uses cryptography to secure and confirm transactions. Unlike traditional currency, cryptocurrency functions independently of a central bank and is decentralized, meaning that it is not controlled by any

government or financial institution. To that extent blockchain technology offers a secure, transparent, and decentralized manner of documenting transactions and transferring assets without the necessity for intermediaries. Anonymity and security are key qualities of cryptocurrency. Fiat currency and cryptocurrency share some similarities in their characteristics, such as acceptability, durability, portability, divisibility, limited supply, and stability. It is worth noting that stability is achieved via measures such as monetary policy and regulation.

There are significant differences between fiat currency and cryptocurrency due to the fact that fiat currency is supported by a central authority, such as a government or central bank, while cryptocurrency is decentralized and functions independently of any central authority. Moreover, fiat currency is physical and tangible, while cryptocurrency is digital and intangible. Additionally, fiat currency is widely accepted and admitted, while cryptocurrency is a new and emerging technology that is not yet widely accepted by businesses and consumers. To that extent, although cryptocurrency revolutionizes the approach concerning money and financial transactions, it still faces a number of challenges and barriers to widespread acceptance and adoption. Furthermore, cryptocurrency has been the subject of certain scrutiny owing to its potential to enable illicit transactions; thus, the decentralized and anonymous character of many cryptocurrencies makes it difficult for law enforcement agencies to trace transactions and identify the individuals involved.

Cryptocurrency is currently categorized by the Internal Revenue Service ("IRS")[48] as property. Moreover, the IRS's classification of cryptocurrency as property is inhibiting cryptocurrency from achieving widespread adoption for the reason that property transactions have reporting requirements.[49] It could be said that re-categorizing cryptocurrency as foreign currency will offer tax revenue that countries need to accomplish their economic objectives. To that extent, Paul DiPadua[50] argues that

> "cryptocurrency is classified as property and cryptocurrency miners can deduct the cost of their electricity from their taxable income. To attain widespread adoption, cryptocurrency needs to be reclassified as foreign currency and the electricity deduction for cryptocurrency miners must be eliminated."

On the other hand, AAI technology should be utilized in producing cryptocurrencies in a quick and safe way; moreover, interconnecting their values to economic assets in order to avoid the overproduction of useless money, which means destabilizing any economy. Thus, automatically, AAI will produce the needed money for the AAI economy, accomplishing the best monetary policy.

It has to be taken into consideration that Bitcoin has redefined the mode that people exchange value and so, for the reason that it is so different from conventional currencies, government regulation has proved problematic. *Kasolas v. Lowe* (in re Hashfast Technologies LLC[51]) involved the transfer of 3,000 bitcoins, which were worth $363,861.43 at the time of the transfer but had grown over the case's pendency to reach over $2.3 million.[52]

It has to be taken into consideration that the issuers of digital tokens may hold nonpublic information about the true predictions of their token, embracing information that contradicts other public statements. At common law, theories of an agent's duty to a principal and of a duty to disclose "special facts" even when one is not an agent gave rise to torts of theft and misrepresentation; therefore, the theft of a business chance from an employer corporation could happen if an executive bought shares in advance of a corporate effort to buy those shares.[53] In line with this, the intent of the information's developer or communicator that it not be used for personal advantage becomes binding on the insider trader by virtue of a relationship of trust.[54] Also, there is the intent to take advantage of other shareholders or corporate stakeholders, or the danger that such victims will miss out to an insider trader.[55] Moreover, there is the recklessness or venality of the insider trader who expressively disrupts a duty assumed to a client, employer, or other shareholders.[56] Furthermore, other than general fairness and enrichment of common law remedies, which were noticeable in the legislative history of the 1934 act, theories diverge on whether they underline the duty of loyalty to shareholders or to the source of the inside information, often the company.[57]

It is argued that insider trading and informed trading by outsiders do not perform distinctly dissimilar functions, and so, it does not matter whether one loses to an insider as opposed to an informed outsider. Thus, the insider's leads, such as low-priced and more precise information, are not automatically socially bad since they may permit price efficiency to happen at a lower overall cost. On the other hand, it could be said that the prospective market advantage of insider trading via greater price competence fails to keep up as shareholders would, via their managerial proxy, use any signaling content of insider trading to affect the signal to their own advantage by inflating prices. Also, it is characteristic that not only managers may be the problem but also shareholders themselves are involved in insider trading. Spindler[58] argues that "If shareholders allow or encourage insider trading because it benefits them, then in terms of magnitude, the requisite deterrent penalties must be shareholder-sized, instead of manager-sized. In other words, they will have to be large."

Has insider trading taken place with cryptocurrencies? Bitcoin is among the cryptocurrencies that "are replacements for sovereign currencies."[59] It is worth noting that a currency is not classically like a security that is promoted as an investment in the future and is matter to the vagaries of one business or a sequence of interrelated businesses.[60] Thus, selling a security in willful violation of one of acts' registration or other obligations may be a criminal offense.[61] Furthermore, a currency is a payment method or "measure of value" that is based on the public and private actions across a sequence of economies.[62] Hence, currencies do not depend on the work product of one management team or network of the currency's users.

It is worth noting that in the leading case of Arise Bank, the SEC claimed that some or all of the founders lied about having a 100-year-old commercial bank and about one founder's Bitcoin and Ethereum trading profits,[63] made untrue assurances concerning the "bank's" token being made available on a linked VISA card, and hid a founder's criminal record.[64] Similarly, the founder(s) of REcoin and Diamond

Reserve Club stated they were supported by holdings in real estate or diamonds that did not exist. Moreover, REcoin apparently made no attempt to begin the real estate acquisitions and specified wrongly the volume of tokens it sold, while Diamond purportedly bought no diamonds and released no Diamond tokens to investors.[65] It is worth noting that several initial coin offerings (ICOs) offered utility tokens yet promoted their offers as security-like investment opportunities, and so, the market experienced asymmetric information which, once exposed, scared off many institutional investors who were confused by the market offerings owing to the way some ICOs portrayed their product.[66]

Can we have aftermarket insider trading? It seems that aftermarket manipulation of token prices may be possible.[67] To that extent, one of the main spikes in cryptocurrencies' possibilities occurred in 2013, when Bitcoin's price rose quickly and so, this rise is tied to "price manipulation"[68] centered on the now-defunct Mt. Gox exchange.[69] Moreover, trading volume for tokens is concentrated on platforms such as Binance, Bitfinex, Coinbase, and Huobi, even though tokens may change hands without such intermediaries. A virtual currency generated and sold by the owners of Bitfinex was involved in pumping up the price of Bitcoin.[70]

It has to be taken into consideration that the distinctive features of cryptocurrencies enhance chances for inside information on cryptocurrency market dynamics. Moreover, aftermarket exchanges exploit the blockchain's touted aptitude as a permanent ledger of asset transfers as a basis for "analytics tools to track and identify bad actors,"[71] and so, activities of bad players have a key influence, as seen with the closure of Mt. Gox in 2014 and the 2018 hack of the Japanese exchange Coincheck, both of which caused losses of tokens amounting to hundreds of millions of dollars, more in Mt. Gox's case as of today.[72] Apparently, investor losses diverge contrary to the length of time it takes for the news of such a hack to reach a specific investor. To that extent, the SEC indicates it as a strict liability offense for a broker in cryptocurrencies to fail to register as an investment advisor or for an offeror or buyer of securities to render a false statement or exclusion of material detail, provoking the question of whether failing to reveal material alterations to the cybersecurity situation concerning an exchange or a digital currency is a breach.[73]

Could aftermarket traders become insiders? The SEC has highlighted that controlling stockholders are insiders who "must disclose material facts which are known to them by virtue of their position but which are not known to persons with whom they deal and which, if known, would affect their investment judgment"[74] but a non-controlling shareholder has a lesser or no duty to reveal material data. In addition, the SEC has confirmed that it is an offense for a seller of securities to fail to affirm a material fact essential to make otherwise correct statements not misleading in a material regard.[75] Alternatively, the Supreme Court affirmed that a buyer of a security that "is neither an insider nor a fiduciary has been held to have no obligation to reveal material facts" to prospective sellers[76] which means that a digital-currency seller may have no duty to reveal if it is not an insider in the network maintained by the token or a fiduciary to digital-currency purchasers.

Anyway, many times, the SEC cannot pursue more than what the defendant obtained from the issue, and so, it is not obvious that federal law is required on top

of state tort or contract law to confine and charge a misleading ICO, or to annul the transaction and place the parties in the status quo ante.[77] Furthermore, it could be said that contract and tort law serve the same purpose; thus, a breach of contract is merely a failure to implement an enforceable contractual promise, resulting in damages to the plaintiff.[78] It has to be taken into consideration that if discrete promises are problematic to distinguish and enforce in multifaceted digital-currency sale bargains, that may present a broad problem under state law, applicable to many sorts of contracting parties other than ICO or AppCoin buyers, and necessitating legal reform. Moreover, if digital-currency sellers are not fiduciaries under state law, other kinds of financial transactions, such as customer accounts, may fall into this disparity too.[79]

It has to be taken into consideration that entering into an agreement owing to fraudulent misrepresentations as to financial health or future strategies amounts to common law fraud and negligent misrepresentation.[80] To that extent, while both fraudulent misrepresentation plaintiffs and negligent misrepresentation plaintiffs have to plead reliance rather than fraud-on-the-market as under some securities laws, this barrier is overcome by supporting that had the plaintiff been told the truth, it would have proceeded otherwise than it did.[81] Thus, if the plaintiff handed over money and/or crypto assets to an entrepreneur who operated as an agent in managing the venture as an investment, the plaintiff has a conversion claim[82] due to the fact that courts have accepted conversion claims against intangible interests such as checks and customer lists.[83] Furthermore, negligence, as the breach of a duty of care to the plaintiff, postulates a remedy to many digital-currency buyers taken into consideration for levying an extra-contractual obligation to convey truthful information[84] without demanding that the asset be of a specific regulatory type. On the other hand, if the economic-loss doctrine or narrow outsets of duty or reasonable reliance prohibit a negligence or negligent misrepresentation entitlement premised upon the managing of digital-currency investors' funds, those doctrines are altered at the state level, possibly in one of the Uniform Commercial Code articles.[85]

It is worth noting that cases such as the Crypto Asset Management implicate negligence at their center.[86] Moreover, there is no evidence today that securities frauds or abuses differ in some direct way from the frequency or results of SEC regulatory activity.[87] Also, while the SEC accumulates more than $2 billion in fines and penalties in a single year, that is a small part of hundreds of billions in fraud-related losses in the non-crypto markets.[88] Additionally, not all SEC proceedings lead to monetary aid for investors, and in the Matter of Tokenlot, LLC[89] the SEC takes most of the ICO intermediary's funds and deposits them in the US treasury, perhaps leaving little or nothing for real victims of false ICOs. In the Crypto Asset Management[90] case, implicating the negligent misrepresentation of being the "first regulated crypto asset fund in the United States" with a registration on file, when nothing had been filed, the SEC achieved a resolution stopping an offering of investment fund accounts or assets and a reformulation of the offering as being made to accredited investors based on the exemption in Regulation D Rule 506(a).

It is argued that a decentralized token or one that is not marketed adequately as an investment with the anticipation of earnings as a result of the issuer's managerial endeavors is not a security.[91] It has to be considered that while some of the hundreds of ICOs are merely contracts sold as investments without bringing any utility in terms of expressive content, others are valuable owing to unlocking applications or networked information, generating "functional cryptocurrencies." It is argued that the SEC hasn't fulfilled its obligation to illustrate that Blockvest's BLV tokens were securities.[92]

It is worth noting that there are extensive First Amendment considerations connected with selling not a percentage stake in a factory or a department store, but access to social media or a virtual world of sorts[93] and so, like the owners of shares in a condominium or a network of payphones, the co-owners of an information ecosystem share out not so much in gains as in computing or software assets that epitomize abstract ideas or creative works.[94] Hence, the ordinary meaning and public understanding of the securities laws do not map plainly onto the crypto world.

Due to uncertainty, the SEC has to affirm that all digital assets are securities under its jurisdiction[95] regardless of the commission acknowledging some uncertainty on several instances about whether existing laws and frameworks cover cryptocurrencies. Corporations that issue securities through ICOs are obliged to abide by existing statutes and rules governing the registration of securities.[96] It seems that not only have both Switzerland and Luxembourg set their jurisdictions as crypto friendly, but also Malta has already created crypto friendly legislation as it converts itself into the "Blockchain Island." France declared its aim to include the issuance of cryptocurrencies as the advancement of this new kind of capital setup, which means the establishment of legal certainty for those who pursue it, without deterring those who go along their own way.[97] Thus, impracticable and unsuccessful declarations about regulatory initiatives could merely drive global capital toward digital tokens in places such as Europe, Asia, or elsewhere where digital money will be regulated. By the way, the Swiss Finma has provided a taxonomy of tokens.[98]

It has to be taken into account that the economic structure dealing with digital tokens and the behavior of their users in blockchain networks plays a central part in incentivizing participation and supporting decentralized ecosystems. It could be said that the term "Tokenomics" encompasses key design choices concentrating on the construction, distribution, and management of digital tokens from a market economics perspective, and so pattern selections are incentivizing participation in blockchain networks.[99] Moreover, "Tokenomics" implicates decisions concerning the supply of digital tokens, their issuance method, and distribution strategy, which means that the total supply of digital tokens has either inflationary attributes or deflationary attributes. Therefore, the liquidity, trading volume, and market capitalization of digital tokens are central to their utilization in the digital economy. Additionally, digital tokens are bought and sold on crypto exchanges, with the price mechanism guiding the actions of market participants. In other words, the implementation of risk management and collateralization mechanisms is central in warranting the stability and security of the market from external shocks, thus diminishing the risk of loss for partakers.[100]

It is maintained that it is essential to declare each smart contract that allows digital tokens to be transferred to be a "national securities exchange" subject to all the registration and filing requirements that this involves. It is worth mentioning here that the SEC considers that EtherDelta is a marketplace that assists in bringing traders of digital asset securities together, by utilizing an order book that records offers to sell and bids to buy, a website that demonstrates those orders, and a smart contract that runs on the Ethereum Blockchain for settlement purposes. Moreover, EtherDelta[101] has the user interface and underlying functionality of an online national securities exchange and is required to register with the SEC or qualify for an exemption.

As mentioned earlier, cryptocurrencies such as Bitcoin are an encouraging alternative to sovereign currencies that have been spoiled or ensnared/entangled by interests not affiliated with the public interest. In other words, the issuance of currencies seems to be captured by individual elites in a way that manipulates the progress of society in accordance with their own interests and not for the good of global society which means that via globalization an effort to manipulate the entire globe against the advancement of humanity might be instigated. Bitcoin seems to allow an elite class of crypto investors to colonize space and accumulate wealth, thus reproducing inequalities in wealth and power at multiple scales which means that crypto assists in novel methods of territorial, resource, and political control while producing asymmetrical dynamics of neoliberal economic progress. On the other hand, it could be said that digital money might work as an alternative possibility of avoiding the manipulation and exploitation of the quantity of money circulating in the market; however, the possibility of independence in generating digital money is questionable since the big powers and elites can control the operability of cyberspace or any other network. Nevertheless, the possibility of having alternative digital money issued independently can keep the issue of money on the right track.

It has to be considered that the decentralization of a crypto network is vital to the director of the SEC's Division of Corporation Finance[102] specifying that the technological or contractual scheme of tokens to operate more like a consumer item and less like a security is noteworthy. Therefore, the Chairman of the SEC specifies that a replacement for dollars or yen as a store of value and medium of exchange would not be a security.[103] Moreover, it is anticipated that the decentralized social production of cryptocurrency value, which embraces noteworthy use-value in some cases for consumers, is influential[104] which means that decentralization through the blockchain gives users decision-making power in the network. It seems that decentralization presents significant advantages by embracing advanced decision-making, censorship resistance, and fairness.

Congress and regulators have decided to leave new devices, processes, and business models relatively unregulated, and so, for AppCoins encompassing use rights on mobile or other computer applications or access rights to network compliance with all of the laws, equalizing market information will be cost-prohibitive and oftentimes actually impossible.[105] Do overbroad regulatory schemes do more harm than good? It is argued that the administrative costs of compliance outweigh the benefits acquired by the scheme, and so with securities registration costs being

assessed at about $5 million, and even compliance with the more modest crowdfunding regulations costing 40% or more of a small offering which means that ICO or AppCoin promoters will pay billions to evade the 30% take of Google, Apple, PayPal, Visa, etc. from apps.[106] Even with an overbroad regulatory scheme, fraud and misleading projections will not be fully avoided, and sectoral crises will persist.[107]

It is well known that legislatures write laws and courts interpret those laws. Legislatures decide what conduct is illegal, and courts interpret laws when they arise in individual cases, which means that the understanding that courts could play a role, let alone a primary role, in determining what conduct should be criminalized is antithetical to the rule of law.[108] To that extent, Neil Gorsuch said that judges "would make pretty rotten legislators."[109]

It could be said that utilizing common law doctrines short of pre-sale registration and periodic post-sale disclosure and filing rations alleviate many of the harms of insider trading without discouraging advantageous cryptocurrency-related activity. To that extent, it could be argued that, in contradiction to broad federal statutes, common law decisions with regard to liabilities and remedies are more predictable and better suited to economic and technical differences among plaintiffs and defendants.[110] On the other hand, for civil law jurisdictions, a well written regulation concerning insider trading can be interpreted accordingly by courts in order to avoid the consequences of extensive insider trading, thereby minimizing its occurrence and its negative economic effects. It is certain that lawful crypto innovators will be able to assist consumers in using tokens to trade for expressive content, as stores of value, and to purchase access to ideas and code.

As mentioned earlier, in response to the law enforcement matters presented by Bitcoin, foreign governments, US regulatory entities, and some US states have endorsed particular controls on Bitcoin and its management. To that extent, many of these regulations touched on, if not fully categorized, Bitcoin's status as a currency or a commodity, but no uniform consensus on that classification has occurred.[111] Furthermore, foreign governments have reacted to Bitcoin in a number of ways, and so some states have banned Bitcoin, while others have considered it a valid form of currency. On the other hand, some states fall in between these two understandings, regulating Bitcoin to some degree, but not fully outlawing it or admitting it as a qualified currency. Hence, countries that have outlawed Bitcoin in some ways include Iceland, Bolivia, Ecuador, Kyrgyzstan, and the Dominican Republic,[112] but these nations have not outlawed the ownership of Bitcoin; nonetheless, they have outlawed most transactions with it, embracing the exchange of Bitcoin for that state's currency, the purchase of Bitcoin, and general transactions with Bitcoin.

Many countries, such as Germany[113] and Sweden,[114] have legalized Bitcoin but subject it to tax and other minor regulations. Moreover, Sweden has made noteworthy mining earnings taxable and prohibited the buying and selling of scrap metal or "waste products" with Bitcoin. In conclusion, a few states have not implemented any regulations on Bitcoin; for instance, Denmark has been aiding the use of Bitcoin and other digital currencies with the purpose of ultimately eradicating

the use of cash.[115] Correspondingly, the Netherlands does not regulate Bitcoin, and many of the state's banks have sought to integrate it into their business to advance competence and diminish costs.[116]

Regardless of the amplified regulatory concerns of misconduct in cryptocurrency markets, cryptocurrency markets are vulnerable to "pump-and-dump" manipulation. There are occasions of fraudulent transactions conducted to inflate Bitcoin prices.[117] It is worth mentioning here that Foley[118] et al. quantify the use of cryptocurrencies in illegal digital markets for buying drugs, weapons, and illegal pornography. Additionally, cryptocurrencies are utilized for tax evasion.[119]

Insider trading is illegal, and insider trading offenses in traditional financial markets are prosecuted. The US SEC initiated the first-ever prosecution of insider trading in cryptocurrency markets. The SEC issued a complaint arresting and charging a former Coinbase employee, his brother, and a friend with wire fraud regarding cryptocurrency insider trading. Hence, the trio is accused of using confidential information about coins that were scheduled to be added for listing on the Coinbase exchange.[120]

It is worth noting that no crypto platform functions as a full-blown stock exchange, and Crypto companies refute that tokens meet the definition of a security. Also, enforcing securities laws, even when they encompass new technologies, is exactly what Congress expects the SEC to do. Moreover, the SEC sued Coinbase, claiming that the exchange violated federal securities laws by functioning as an unregistered broker, exchange, and clearing agency for cryptocurrencies that were securities.[121]

Insider trading happens when market participants trade using confidential information not known to the general public, originating within a corporation or a transaction having an economic impact. Notwithstanding intensifying mainstream and institutional participation in cryptocurrency markets, regulators remain concerned about an assessment that cryptocurrencies function in an anarchic territory, inspiring some participants to engage in illegal activities in traditional financial markets. Storing and trading cryptocurrencies is done via software called a "wallet." It is argued that abnormal return run-ups take place in advance of the official exchange listing announcements, similar to prosecuted cases of insider trading in stock markets[122] and by utilizing blockchain data, we will trace the individuals' wallets that steadily trade in advance of listing announcements, finding evidence that rules out other justifications for the return run-ups. Hence, the value generated from cross-listings generates risks to market functions such as insider trading.[123]

It could be said that taking into account that inside information flows through strong social ties, insiders trade off profits and risks of prosecution, but the transparent and public character of blockchains permits offering evidence that return run-up patterns occur in markets where the detection/prosecution bias is not present.[124] Is there insider trading in cryptocurrency markets? It has to be taken into account that cross-listings augment the value of tokens and so, the escalation in value is attributed to superior information production which means that cross-listing generates opportunity for insider trading by utilizing advanced knowledge of listing decisions. E. Felez-Vinas, L. Johnson, and T. J. Putnins[125] find

> "evidence of systematic insider trading in cryptocurrency markets, where individuals use private information to buy coins prior to exchange listing announcement…evidence consistent with insider trading ahead of 10-25% of cryptocurrency exchange listings. We examine price run-ups as per insider trading in stock markets and more direct evidence from the blockchain. These findings point to cryptocurrency markets being susceptible to the same forms of misconduct that regulators have for a long time grappled with in traditional financial markets"

and so, profit from the typical price surge that follows the announcement.

Also, insider trading takes place on listing announcements and concerning tokens that are available to trade on DEXs in advance of the listing. It is worth noting that DEXs have no Know Your Customer (KYC) or Anti-Money Laundering (AML) obligations, offering the opportunity for people to trade pseudo-anonymously and unrestricted. Even though there are no direct KYC or AML obligations, DEXs are entirely transparent, with all trades publicly available on the blockchain.

It could be said that insider trading is disadvantageous to the reliability of cryptocurrency markets and its existence damages investor confidence. It has to be taken into consideration that in the case that investors deem cryptocurrency markets to be susceptible to extensive insider trading, they prefer not to take part in them, thereby obstructing gains from trade, which means that lawlessness and extensive mishandling block the implementation of cryptographically secured ways of representing securities and other financial instruments. The SEC takes action to control insider trading in cryptocurrency markets.

The growing popularity in the cryptocurrency market that resulted in the creation of more crypto products further acknowledges the demand for regulators to explain its categorization. Hence, unlike fiat currencies, which are backed by the central bank and government, virtual currencies are not backed by any sources classified into "centralized" and "decentralized."[126] To that extent, centralized exchanges present a platform for users to trade on and are controlled by a centralized entity, while decentralized exchanges permit users to control their assets on the blockchain, being private and more anonymous; thus, authorities need to supervise decentralized cryptocurrencies.[127]

Taking into account that payment data contains information that can be used for price discrimination, DeFi incorporates a wide range of financial applications founded on secure distributed ledgers, similar to those used by cryptocurrencies.[128] DeFi solves the problem of data manipulation with the distributed ledgers, effectively settling the problem effectively.[129] Moreover, virtual currencies should be accepted by natural or legal persons as exchangeable assets that are transferred, stored, and traded electronically.

The short analysis shows the appearance of new information concerning data, crypto assets, and e-money, which means a new zone for insider trading. Hence, AI technology contributes to identifying movements regarding information and e-money circulation, thereby spotting abnormal activities or nonpublic information utilized by participants in all kinds of markets. On the other hand, AI systems

might conceal insider trading due to its electronic character. Zekos argues that the development of AAI technology functioned by AAI entities in objectively running AAI markets will spot insider trading through automatic and autonomous decision-making because the whole systems will be controlled from the entry of any data into the systems and the market and the actions and profits of any legal entity.

5.7 Insider Trading and EU Law

As mentioned earlier, the Market Abuse Regulation constitutes today's regime for insider trading, and an accompanying Directive tackles criminal sanctions for insider trading.[130] Additionally, the EU Market in Crypto Assets Regulation contains its own regime on insider trading in crypto assets that do not qualify as financial instruments.[131] MiCAR is extending insider trading law to various digital assets. Furthermore, crypto assets admitted to trading qualify under MiCAR's insider trading prohibition and also digital investment tokens that qualify as a financial instrument under MiFID II fall under MAR's insider law.

It is characteristic that US law has inspired European insider trading law regarding terms such as inside information, materiality, and the reasonable investor. Nonetheless, the policy objectives underlying insider trading law diverge. On the one hand, the United States relies on classical and misappropriation theories of insider trading. On the other hand, EU law considers insider trading law mainly as a contribution to efficient markets by encompassing an obligation to immediately disclose material information to the market. Hence, equal access to information and fairness for investors are objectives underlying EU insider law by obliging the reporting of all material information to gain transparency in gaining transparency on financial markets.[132] Katja Langenbucher[133] argues that

> "While USA law relies on classical and misappropriation theories, European law explains insider trading prohibitions from the perspective of promoting market integrity, investor protection and fairness to individual investors. This leads to European law's egalitarian disclosure obligation which stands in contrast to the lack of affirmative duties to disclose under USA law."

Insider trading entails an unfair advantage being gained from inside information to the detriment of third parties who are unaware of such information. It has to be taken into consideration that EU insider law combines an insider trading prohibition and a disclosure obligation, which means that the public disclosure of inside information by an issuer is fundamental in averting insider trading. Inside information covers any nonpublic information involving an issuer or a financial instrument that, if made public, would be expected to have a substantial effect on the prices of the instrument or a related derivative. Furthermore, unspecified information is considered to be mere rumors.[134] MAR targets information relating to issuers or financial instruments, and MiCAR adds issuers and crypto assets. Additionally, MiCAR encompasses inside information on offerors of a crypto asset and persons seeking admission to trading. While MAR includes effects on the financial instrument and

related derivatives, MiCAR refers to relevant information if it influences the price of the crypto asset to which the information relates or the price of a related crypto asset (Art. 87§1(a)). It is worth noting that the EU policy concentrating on market integrity and investor protection captures insider trading on crypto markets more broadly when compared to the US policies on classical insider and misappropriation theories.

Disclosure is only lawful if it is absolutely necessary for the exercise of those duties.[135] To that extent, it is vital for investors' confidence in a functioning securities market, which depends on "being placed on an equal footing and protected against the improper use of inside information."[136] Moreover, the E.C.J. settled that information in order to be precise has not to be "vague or general" information "from which it is impossible to draw a conclusion as regards its possible effects on prices."[137]

Finally, it is worth mentioning here that EU Member States have broad discretion in transposing MiFID II and in defining what counts as a security under their national law. Across the EU, member states have dealt very differently with investment and currency tokens. Thus, the current model of the EU is failing to have a common policy due to national laws, which means that the emergence of the model USE will allow for the proper and uniform application of all laws as a real political entity.

5.8 AI and Insider Trading Developments in EU and US

First of all, inside information runs through strong social ties grounded in family, friends, and geographic proximity.[138] Today, trading based on traditional inside information as well as outside information is regarded as insider trading in violation of Rule 10b-5. Because neither the text nor the legislative history of Exchange Act § 10(b) nor Rule 10b-5 defines insider trading, it was left to the courts to work out not just the appropriate legal rules but also the rationalization for prohibiting insider trading.[139]

A violation of Rule 10b-5 involves a showing of scienter and some form of deception, characteristically a misrepresentation of a material fact or silence in the face of a duty to speak.[140] The standard for scienter is different in criminal and civil cases, but in order to meet the *mens rea* standard in a criminal case, it entails willful or knowing conduct, whereas recklessness suffices in a civil case.[141] It is worth noting that the SEC charged a company executive with insider trading through a Rule 10b5-1 plan and also charged the same executive with control person liability with respect to trades made through an entity he controlled.[142] Also, the SEC recently brought an insider trading case against an insider who traded on the basis of MNPI about his company and also tipped four of his friends who also traded. Furthermore, the SEC charged the tipper and the four tippees with violations of Section 10(b) and Rule 10b-5, and disjointedly charged the four tippees with aiding and abetting the tipper's violations.[143]

Insider trading is a new piece of information to the market as the considerable adjustment of stock prices is empirically documented. Moreover, insider trading

is not defined in federal securities laws, so the courts are left to interpret whether insider trading is fraudulent and, more particularly, to describe material, nonpublic insider information.[144] To that extent, the lack of a statutory or regulatory definition in this regard is upsetting and out of line with many jurisdictions.[145] In EU the offense is defined in a statutory directive, the Market Abuse Directive.

It is characteristic that under the classic doctrine, corporate insiders cannot trade on the basis of private material information in the shares of their corporation unless they disclose such information to the transacting party. In the meantime, under the misappropriation theory, one is not permitted to trade on information that was acquired in a fiduciary relationship or in breach of fiduciary duty. Moreover, under the misappropriation theory, liability is irrelevant in three settings. First, there can be no liability if the outside trader discloses his intention to trade to the source of information. Second, outsiders who do not breach a fiduciary duty can freely trade on the information. Third, original sources of information can trade on the information that they produce, implying that a company can freely trade on the information it produces without violating any duty. As Mehta[146] et al. explain, "the legality of shadow trading appears to be relatively untested due to the lack of a clear breach of fiduciary responsibility by insiders who use private information to facilitate trading in other firms," and at any rate that "prosecutions for shadow trading are virtually non-existent."

The legality of shadow trades is being litigated in SEC v. Panuwat, a case in which a business development head of a pharmaceutical company traded in the stocks of a competitor. Moreover, in Panuwat[147] case, the court explained that information is material to more than one firm and a violation takes place if one trades on material nonpublic information in "*any* security," and "Section 10(b) and Rule 10b-5 cast a wide net, prohibiting insider trading of "*any* security" using "*any* manipulative or deceptive device.""" Further, the court requires that the information be material and nonpublic, which means that Rule 10b5-1(a)'s list of manipulative and deceptive means is not exhaustive as a result of the language that "manipulative and deceptive devices include, among other things." It could be said that the SEC denotes that Panuwat committed insider trading regardless of having no tie to Incyte or its employees whatsoever and thus grounded its charges on misappropriation theory, reasoning that Panuwat owed a duty to Medivation as the source of the information to refrain from trading, which means that shadow trading falls within the limits of existing insider trading precedent. It could be said that Panuwat encompasses trading on information regarding one business that materially affects another in the same industry, and so parties involved in the capital markets need to consider the increased risks and perils that come with trading in a post-Panuwat market.

It has to be taken into account that exchange-traded funds (ETFs) are used in a new form of insider trading known as "shadow trading," and so some traders in possession of material nonpublic information regarding upcoming M&A announcements trade in ETFs that hold the target stock, rather than trading the underlying corporation shares, by this means covering their insider trading. It is worth mentioning here that shadow trading occurs in most sectors, and insiders earn

noteworthy and economically meaningful returns from trading ETFs in advance of price-sensitive news, which are comparable to the returns earned by insiders trading stocks prior to other major corporate news.[148] Company insiders utilize private information about their own company to trade in related corporations such as business partners or competitors, and so shadow trading goes beyond related firms taking part in economically meaningful scales in ETFs, which means that insider trading in stock markets is pervasive due to the fact that insider trading is even broader, appearing in securities other than the stocks themselves, such as options markets.[149] On one hand, ETFs are considered passive investment tools as by construction they track various indices. On the other hand, the increasing number and diversity of ETFs, along with escalations in ETF liquidity, offer cost-effective tools for informed traders to profit from their private information. Hence, unusual upturns in ETFs indicate discrepancies in advance of revelations in macroeconomic news such as the consumer price index and gross domestic product.[150] To that extent, Elza Eglīte et al.[151] find

> "that shadow trading in ETFs is more likely when insiders can strategically trade and hide their private information in liquid ETFs and when their private information is more valuable resulting in larger ETF trading profits. We find that shadow trading in ETFs prior to M&A announcements is most prevalent in the Health Care and Technology sectors."

It is characteristic that exploiting bootstrap techniques to identify abnormal trading in treatment and control samples, significant shadow trading of same-industry ETFs prior to M&A announcements is spotted, which means that insider trading is more pervasive than just the "direct" formulas. M&As have noteworthy impacts on stock prices, generating strong motivations for illegal insider trading.[152] Furthermore, traders have employed new strategies to evade discovery by law enforcement agencies for illegal insider trading, such as trading in related securities encompassing trading in economically related companies. It is worth noting that while both shadow trading and traditional illegal insider trading are founded on private information about a corporation, the former engages in trading shares in a related company and the latter concerns trading shares in the company directly.[153]

Trading in breach of confidentiality agreements was the basis for the conviction of a medical doctor who held a senior role at one clinical trial site. In fact, Kosinski traded based on nonpublic inside information by betting against Regado's stock and purchasing put options from which he realized a net profit of $3,300 when Regado publicly announced that it had permanently terminated the clinical trial.[154] Kosinski owed a duty to Regado not to trade in Regado's stock grounded on confidential, nonpublic information, absent disclosure to Regado. Kosinski's relationship with Regado was fiduciary in character since it was a relationship grounded upon trust and confidence. The written agreement with Regado necessitated Kosinski to keep in "strict confidence" the information he obtained in the course of the trial. Kosinski was entrusted with Regado's information especially because of his duty to safeguard the integrity and accuracy of the phase three clinical trial. Kosinski

traded on Regado's nonpublic inside information without disclosure to Regado and so, he "misappropriate[d] confidential information for securities trading purposes, in breach of a duty owed to the source of the information."[155] Hence, conviction rests on the "misappropriation theory" of insider trading, under which a person commits securities fraud if he "misappropriates confidential information for securities trading purposes, in breach of a duty owed to the source of the information."[156]

In *United States v. Chow*[157] held that, under the misappropriation theory, the managing director of an investment corporation, by virtue of entering into NDAs, retained a legal duty of confidentiality not to share information about an impending acquisition of a semiconductor manufacturer, which means that individuals who enter into confidentiality agreements, and in that way get corporate information that they agree not to disclose, turn out to be "temporary insiders" with fiduciary-like duties. Hence, there is an insider trading violation for independent contractors to trade stocks grounded on information made available to them while subject to a confidentiality agreement.[158] Thus, an NDA forms a duty of trust and confidence, expanding this duty of confidentiality to a prospective acquiror and target engaging in arm's-length negotiations. In other words, stocks cannot be traded grounded upon nonpublic information ascertained in confidence by "temporary insiders" notwithstanding formalities such as whether the trader was technically an employee at the time the information was ascertained. Temporary insiders are banned from trading under both the classical and misappropriation theories without the requisite disclosure.

It has to be taken into account that while insiders are informed traders, they are not a uniform group that is equivalently informed. Moreover, a state's legal system governing insiders by determining the institutional environment boosts the trading behavior of insiders. Lai T. Hoang[159] et al. argue that

> "AU insiders have superior information to earn abnormal returns. However, we then report a stark contrast between AU and U.S. insider trading behaviour: while U.S. insiders are dominated by sellers, the majority of AU insiders are buyers. This leads us to show that, contrary to AJK, investment horizons of AU insiders are not predictive of future returns, and therefore do not have information content."

There are a variety of criminal conspiracy statutes that authorities have charged in insider trading cases.[160] Under the conspiracy statutes, tippers and tippees are acting in concert as part of a common scheme to defraud. In Blaszczak, the court, after finding that confidential government information did not establish "property" for purposes of Title 18 wire fraud or securities fraud, the court in Blaszczak II[161] individualized a conspiracy under Section 371, noting that that statutory provision is not restricted to property interests. Furthermore, in *Blaszczak v. United States*[162] *the court is* generating uncertainty as to whether confidential information held by a federal agency could trigger an insider trading or wire fraud conviction, which means that another hole is created allowing insider trading in the market. Additionally, the court's decision in *Kelly*[163] eventually excludes insider trading

convictions grounded on government employees disclosing confidential government information.

It has to be taken into account that monitoring of abnormal trading should be more wide-ranging than just the shares of companies. Abnormal alterations in the market will be spotted by AI systems, and so, identifying abnormal selling and buying of shares due to information that has not be made public prior to the abnormal activities. On the other hand, due to digitization via AAI objectively running all information will be made public automatically, and so, not be a window for insider trading.

It is worth mentioning that the US and the EU illustrate considerable divergence in the regulation of outsider trading. In fact, outsider trading is the sale or purchase of listed securities on the basis of material nonpublic information by persons who do not qualify as "insiders." There are several ways in which outsiders get MNPI: stealing it from its rightful owner, receiving it as a "tip" either voluntarily or unintentionally from an insider, and ultimately obtaining it due to their independent and legitimate search efforts leading them to the discovery of "hidden" new material information, unknown to the investing public. While US law allows the possibility of outsider trading, EU law unconditionally forbids it. Restraining outsiders' exploitation of material nonpublic information has a sound competence-grounded justification, but an unconditional ban on all informed trading by outsiders seems to be damaging, deterring investors' motivations in searching for new information, lessening market effectiveness, and escalating agency costs for publicly traded companies. Moreover, US law, with its selective limitation of outsider trading, seems to be immune to these costs. On the other hand, EU law has the potential to carry on such drawbacks. Firstly, in the EU, any outsider in possession of "inside information" or material nonpublic information has to abstain from trading if he knows or should have known that the information he possesses is inside information. The legal treatment of outsider trading is basically equalized to that of "ordinary" insider trading, as both are unconditionally prohibited and sanctioned. Secondly, the US legal system does not forbid outsider trading unconditionally, and the outsider has to have misappropriated the information, in breach of a fiduciary duty or of another relation of trust and confidence owed to the source of the information, or he has to have received the information as a tip from an insider, knowing that the latter provided the information in exchange for personal profit. Trading by outsiders on the basis of MNPI is, in principle, allowed.

There is a broad, system-wide difference between Europe and the US regarding the legal treatment of trading by reason of material nonpublic information: in the EU such trading is forbidden per se, while in the US it is not, as the trading exclusion applies only selectively. The EU conforms to a parity-of-information principle in the regulation of securities trading which the US discarded long ago in support of the existing approach, according to which not all informed trading is banned. The EU framework has its own advantages assisting enforcement, by reducing prosecutors' evidential burden, filling the gaps left by the more restrictive approach adopted by the US. It could be said that US law accepts outside investors' exploitation of informational advantages more easily than EU law.

Corporate insiders and individuals with a fiduciary duty to a corporation are banned from tipping insider information to others for the purposes of trading. Tipping takes place when a tipper offers material, nonpublic information to a tippee, and the tippee then trades on that information. It has to be taken into account that liability does not compel evidence that the tipper received pecuniary gain; thus, when a tipper passes inside information to "a trading relative or friend," then the tipper offers "the equivalent of a cash gift."[164] A tippee is liable for insider trading where the tipper has breached their fiduciary duty by disclosing information to the tippee, and the tipper receives a personal benefit from the disclosure. The personal benefit part is fulfilled where there is evidence that the tipper planned to benefit the recipient.[165] Hence, the application of the law of tipping in the clinical trial setting concentrates on whether the tipper would profit by tipping and what the nature of the benefit might be.

It is argued that shadow trading causes problems for corporate insiders, leading to excessive corporate risk-taking and, consequently, generating risks to the entire economy and exacerbating economic crises due to the fact that the complicated legal standards of insider trading liability impede investors from contributing to securities markets since they do not have the expertise and resources to conduct the vital compliance analysis.[166]

AI systems are increasingly integrating into the society and so algorithms will make corporations more efficient and so robotics.[167] It must be taken into consideration that algorithms may soon replace employees as the leading source of corporate harm.[168] To that extent, the law has outlined corporate misconduct, such as civil discrimination and criminal insider trading, in terms of employee misconduct. Moreover, AI and big data permit automated systems to make many corporate decisions; thus, these technologies present significant efficiencies, but they do not eradicate the incidence of corporate harm. It could be said that unless the law adapts, corporations will gradually become immune to civil and criminal liability as they transfer accountability from employees to algorithms. To hold companies accountable, the law must sometimes treat them as if they "know" information stored on their servers and "intend" decisions made by their automated systems. In the case of "Marvin," one of many algorithmic trading programs in use today, the insider trading inquiry quickly aborts because Marvin is not a human employee, and thus the law has no way to say SciBank knew the information about BigCo's planned acquisition, making liability for insider trading a nonstarter.[169] It could be said that the programmers can be excused for insider trading since they benefit from insider trading.

It has to be taken into account that insiders trade more forcefully when the difference between the observed stock price and the fundamental value is larger and when the signal about a stock's fundamental value is more accurate. Pat Akey[170] et al. find that "equity volume, equity turnover, and option volume were significantly higher in stocks for which the informed traders had access to upcoming earnings news…liquidity providers responded to this increase in informed order flow by charging higher spreads," which means that liquidity providers react to aggressive explosions of informed trading. Insider trading has predictive power for future

stock returns by disclosing information influencing the price of stocks and, thus, insiders buy shares in temporary mispricing. Hence, insider trading enhances stock price efficiency by stimulating stock price discovery. Also, the market incorporates insider trading information into the prices of overvalued stocks, but vital information remains unrevealed by insider trading.[171]

It is characteristic that insiders divert aggressive earnings-based trades into planned trading accounts after Rule 10b5-1 offers evidence of an unintended consequence of Rule 10b5-1 through the manifestation of insiders' plan sales after earnings results.[172] Hence, insiders utilizing their knowledge about upcoming poor earnings performance sell shares before the disclosure of bad news. Also, insiders' nearly perfect planned trade timing originates from their capability to affect the timing and amount of earnings recognition, which means that insiders organize a trading plan in the absence of material earnings news by swaying earnings upward to boost stock prices to sell shares at inflated prices under their trading plans. Thus, managers maneuver earnings upward around their 10b5-1 sales either to sell shares at a higher price or to lessen the probability of litigation from insider sales. CEOs and CFOs who sell under these plans are expected to participate in strategic behavior to meet or beat expectations in a struggle to maximize their earnings from planned sales. In line with this, Yen-Jung Lee[173] finds that

> "insiders make the following types of trades: non-routine, infrequent, one-time, close to the plan initiation date, and during traditional earnings announcement blackout periods. I further find that these insiders are employed at firms with weaker governance, lower institutional ownership, and lower analyst following…insiders shift their information-based sales from non-10b5-1 to 10b5-1 trades after the implementation of Rule 10b5-1, revealing an unintended consequence of Rule 10b5-1."

Furthermore, in 2023, the SEC amended Rule 10b5-1, imposing several new requirements on Rule 10b5-1 plans, including: "(1) a cooling off period; (2) a certification as to the absence of possession of noany material nonpublic information; (3) limitations on overlapping and single trade plans; and (4) a requirement to act in good faith"[174] which means that the cooling off period obliges Section 16 officers to wait the longer of: (1) 90 days following the adoption of a 10b5-1 plan; or (2) 2 days after the release of fiscal results to trade in their corporation's securities. To that extent, Karen E. Woody and Cole Davidson[175] argue that

> "Rule 10b5-1 should be extended to cover trading in peer firms, given that the SEC is now charging shadow trading as an extension of the misappropriation theory of insider trading. The SEC's extension of misappropriation theory prohibits the use of inside information in firms other than the one for which a defendant may possess inside information."

It has to be taken into consideration that insider trading undermines investor confidence, increases the cost of raising capital, and, accordingly, limits funds available for innovative activities. Hence, restricting insider trading activities prevents

insiders from accessing and trading on private information, increasing investor confidence and eagerness to offer capital, which means that with more capital available, corporations invest in research and development, resulting in more innovation. Thus, the prospective of greater rewards from insider trading activates insiders to innovate. Moreover, external insider trading restrictions target insiders who capitalize on and trade on private information they possess as a result of their unique positions. Likewise, internal insider trading restrictions, such as blackout policies, are compelled by corporations restraining insiders" trading activities around significant news releases like earnings announcements to preclude transacting on nonpublic information. Chen, Jiawei[176] estimates that "corporate innovation is higher following insider trading restrictions. This is consistent with the view that insider trading restrictions spur firm innovation activities by attracting investment."

Opportunistic insider trading is a money-spinning trading taking place within a month of quarterly earnings announcements because these announcements are the most vital and frequent dates for material information disclosure by corporations.[177] Hence, insiders trade on foreknowledge of future events such as earnings restatements, M&A deals, and security offerings, and by using private information, such as foreknowledge of reported performance, corporate events, and analyst research announcements. In the same way, insiders sell well in advance of a break in uninterrupted increases in earnings, and so insiders stop their monotonous trades based on upcoming earnings announcements.[178]

Corporate insiders, such as CEOs, CFOs, and other senior managers, are informed investors since they are closely implicated in the daily operations of their corporations and have superior access to price-sensitive information compared to outside investors. Xiaoke Ye[179] shows that

> "insiders will sell for their personal gains as well. Since sell transactions are significantly larger than purchase transactions, they will generate a large amount of dollar profit for corporate insiders. Moreover, the study shows that insiders' informational advantage also exists in understanding public information because the supply chain facilitates the flow of information."

On the other hand, it is argued that mandatory disclosure protects vulnerable investors by setting minimum obligations for information disclosure. Corporate executives manipulate the timing and content of information disclosure to gain from their preplanned transactions, denoting a failure of the SEC 10b5-1 rule on insider trading due to the fact that insiders are "perfect" timers and thus, corporate disclosure profits preplanned trades.[180]

It has to be taken into account that investors must understand foreign information regarding MNEs due to the fact that foreign information is slowly priced into the equity of MNEs, and so, insiders at MNEs gain more from the relatively obscure information environment about MNEs, paralleled with domestic corporations. Thus, the superior profitability of insider trades at MNEs is principally detected in insider purchases.[181] Additionally, MNE insiders profitably buy underpriced value stocks with low past returns, and so they trade more profitably, not

only as a result of market pricing openings but also owing to the advantageous timing of informed trades before earnings announcements. To that extent, D. M. Alldredge and D. B. Blank[182] find that

> "insider purchases at multinational firms predict larger abnormal returns than insider purchases at domestic firms. Insider trading profits are concentrated with insiders that possess the highest level of information (i.e., insiders that hold the role of CEO, President or Chairman)…the profitability of insider purchases in multinational firms may be lower when investor attention is high and higher among value stocks that have recently underperformed."

Relying on laws meant to protect private rights and to penalize information inequality instigates insider trading law to invoke at least two conceptions of fairness—property-based fairness and equal-information fairness—and so confusion in US insider trading law is rationalized by the insurmountable conflict between property-based fairness doctrines and economic-equality-based fairness doctrines. To that extent, Kevin R. Douglas[183] argues that

> "clarifying insider trading law by specifying whether consent is a defense against liability. Making consent a defense against liability is in harmony with a property-based fairness doctrine, and barring consent is in harmony with an equal-information-based fairness doctrine. Enforcing only one fairness doctrine allows everyone to attempt to privately adhere to both principles while successfully applying one of the principles through law."

Overall, the internal governance of insider trading has to be strengthened, and the efficacy of board oversight should be a key consideration, which means a need to take a dynamic view of corporate governance. Furthermore, analysts or brokers tip a subset of informed retail investors who engage in abnormal and profitable trading based on their access to private information that, in this case, originates from financial institutions.[184] Henk Berkman et al.[185] argue that

> "financial professionals trade in ways that might be of more concern to regulators, displaying exceptional stock picking skills on both the buy side and the sell side, with profits that accrue over short windows that extend from a few days to a month. They also profit by trading ahead of firm-specific information events, and appear to generate at least some of their profits by trading on private information obtained in their capacity as access employees of a financial institution, which implies a potential violation of securities law."

Moreover, brokers who are more central in the broker network reveal information about informed trades that they execute, first to their best clients and later to other institutions[186] and so, analysts affiliated with these brokers issue more accurate earnings forecasts.[187] On the other hand, financial intermediaries are anticipated to check the personal trading of their employees, making certain that this activity complies with insider trading rules.[188]

Corporate insiders are clearly informed about their own firms. Moreover, if corporate insiders truly consider that short sellers have no valuable information, then their trades are uncorrelated with or opposite to those of the short sellers. Furthermore, corporate insiders and short sellers are deemed to be better-informed market participants, and the existence of short sellers initiates prospective trading competition and, consequently, alterations in the selling conduct of insiders. It is characteristic that short sellers earn large returns by trading soon after the release of public information, which means that short sellers are skilled at processing public information signals. Thus, informed agents trade options more often for negative signals than for positive ones because of equity short-sale costs. It could be said that traders with negative news are expected to shift from equities to options when short-sale costs increase. To that extent, S. Wang and L. Zheng[189] argue that

> "corporate insiders have better price-forecasting power than short sellers. Such a positive relationship is more significant when information asymmetry is high, supporting the argument that insider buying contains superior information that short sellers do not have…short-selling reversals after the public disclosure of insider buying following a disagreement, which further confirms that a disagreement is due to the information barriers between insiders and short sellers."

It is worth noting that the market makers cannot distinguish the trading of the insider from the trading of the noise traders, who in effect offer camouflage, which allows the insider to make profits at their expense. The information disadvantage of outsiders can be curtailed through more timely disclosure of insider transactions.[190] It must be taken into consideration that society can achieve a reduction in insider trading if insider trading regulations provide meaningful criminal deterrence. Furthermore, Kacperczyk and Pagnotta[191] infer that "insiders internalize the legal threat by adjusting their trading strategies. Insiders' responses also reflect on asset prices and the average values of the private signals across legal risk regimes." It seems that financial crimes take place due to motivation and opportunity, which means that participants have the opportunity to act because of the absence of the law and effective enforcement, leading to the motivation to commit the crime generating analogous gains.[192]

Investors are selling an asset when it is at a gain rather than when it is at a loss. Taking into account that informed investors monitor a noisy private signal about asset payoffs and noise traders" positions influence the net supply of the asset, in such a market, the market-clearing price acts as an endogenous public signal of the asset payoff. It is worth noting that the aggregation of dispersed information transpires as the central power establishing asset prices and anticipated returns and thus, offers a cohesive explanation for several noticeable asset pricing anomalies such as negative excess return to skewness, which means substantiating the influence of investor disagreement on returns in equity and bond markets. In line with this, Elias Albagli[193] et al. argue that "noisy aggregation of dispersed information in financial markets…provides a unified explanation for several prominent cross-sectional return anomalies."

5.9 AI Logistics of Information Is the Remedy against Insider Trading

Logistics can be used to control information flow within a company and the distribution of information to the public. Additionally, AI logistics will have another capability through the capacity of AI and shortly that of AAI technology, running objectively and not grounded on any programmer's wishes, in making information public in seconds since the whole system will run autonomously via AAI systems contacting AAI decision-making without any humans' intervention. Zekos considers that the establishment of logistics of information via AAI technology functioning objectively in the company, in relation and in connection with the establishment of logistics of information in the stock exchange and the SEC creating a network of logistics of information will be the antidote against insider trading and market manipulation concerning the governance of information, which is the basis and the weapon of insider trading. The development of a network of logistics of information will make possible the just-in-time arrival of information to the market, eradicating to nearly an absolute degree the time advantage of any person wanting to get involved in insider trading. Logistics of information will govern the informational picture of the company. Additionally, logistics of information should achieve the goal that information will reach the market at the right time and the right speed in order to formulate the correct price of the stock. Governance of information via logistics of information will manage to offer information just in time to the market in order to achieve the right stock price representing the real value of the company based on the real informational picture.

Taking into account that technology for transferring information across time is "asymmetrical," an insider awaits more information advantage in the future, which means that an insider would not dissimulate and utilize all private information by embracing a pure strategy. In line with this, H. Yan et al.[194] argue that

> "the insider in our trading game "smooths" his information usage over time given the dynamic constraints imposed by the sequential arrival of his private information. Specifically, the dynamics of the insider's trade strategy are shaped by the comparison between his current private information and his anticipated future private information."

Will AI insider trading be possible in the AI era? The answer depends on the objectivity of the stock market run by AI technology. If the stock market runs based on a less advanced AI technology than the one utilized by insiders, then AI insider trading will take place before it is spotted.

5.10 Insider Trading and Accounting

First of all, it seems that accounting has been an instrument utilized by companies in order to present the profits of a company accordingly, so people knowing in advance the outcome or the complexity of the accounts of the company can contact insider trading for their own gains. It is argued that accounting disclosure is reported in favor of insiders during political uncertainty.[195]

Generally accepted accounting principles (GAAP) refer to a common set of accounting rules, standards, and procedures that encompass the details, complexities, and legalities of business and corporate accounting. The Financial Accounting Standards Board (FASB) uses GAAP as the foundation for its comprehensive set of approved accounting methods and practices, and so GAAP compliance makes the financial reporting process transparent by standardizing assumptions and methods. Investors and stakeholders are empowered to make sound, evidence-based decisions. To that extent, the consistency of GAAP compliance permits corporations to more easily evaluate strategic business options. SEC compels publicly traded corporations to use GAAP accounting in the first place. On the other hand, non-GAAP earnings, excluding "one-time" transactions, are an alternative accounting method for measuring the earnings of a corporation, and so corporations report non-GAAP earnings along with their earnings based on GAAP offering a more accurate measure of a corporation's financial performance from direct business operations. Moreover, non-GAAP financial measures make available a more profound picture of the corporation's performance and value. To that extent, investors have no way of knowing whether "Non-GAAP EPS" figures are real or manipulated in an effort to mislead the automated news-watching trading algorithms into taking action as the outcomes are published in headlines.

Do insiders profit from their information advantage about corporate non-GAAP earnings disclosures? It has to be taken into account that insiders have private information and often disclose non-GAAP earnings metrics with the claim that such metrics enlighten investors concerning earnings persistence. Nonetheless, for the reason that insiders have private information regarding earnings persistence, they have opportunities to take advantage of this information by trading on it following non-GAAP earnings announcements. To that extent, Dirk Black and Bo Gao[196] find that

> "insiders at firms that disclose non-GAAP earnings sell more shares of stock than insiders at other firms immediately following quarterly earnings announcements. This evidence is more pronounced for firms that: 1) Are monitored less intensively; 2) Are led by high-ability managers; and, 3) Disclose non-GAAP earnings more aggressively. Importantly, we also find that these insider sales enable managers to avoid statistically significant negative abnormal returns."

It has to be taken into consideration that the US SEC expresses concerns regarding investors being misled by non-GAAP disclosures and about the aptness of non-GAAP metrics. Corporations' disclosure of non-GAAP financial measures in their earnings announcements is prevalent, and managers' motivations for non-GAAP disclosure are not well-defined.[197] Moreover, executives and directors have significant stock holdings in their corporations. Taking into account that managers' non-GAAP disclosure selections are their private inside information about past, current, and future operations, this private information empowers managers to select disclosing non-GAAP financial measures, offering investors value-added

signals of persistent earnings or manipulating investors' insights regarding persistent earnings.[198] Hence, for the reason that managers select what to embrace or ignore from their non-GAAP financial metrics, managers obtain "pecuniary benefits" from investors by trading on this private information. Also, the dominance of non-GAAP earnings disclosure is expanding along with the reality that non-GAAP disclosures play a decisive part in managers' financial communication strategies. This means that non-GAAP disclosures offer managers more flexibility to transmit information concerning core earnings persistence, as non-GAAP earnings figures are only formally controlled by SEC rules concerning their appearance and reconciliation to GAAP. On the other hand, non-GAAP earnings are a matter of managers' subjective variations and are not audited[199] which means that managers are exploiting non-GAAP earnings strategically to affect investors' assessments regarding the performance of the corporation. Likewise, even though non-GAAP earnings disclosures are instructive to investors regarding future performance, there are managers profiting from inside information about the recurring parts of earnings. Hence, insiders at corporations that disclose non-GAAP earnings are drastically more likely than insiders at corporations that do not issue non-GAAP earnings to sell shares in a short ten-day window instantaneously trailing the quarterly earnings announcement date which means that insiders at corporations that disclose non-GAAP earnings have expressively bigger buy-sell imbalances than do insiders at corporations that do not disclose non-GAAP earnings in this short window.

Corporate officers and directors are accountable for the preparation of corporate mandatory financial reports and voluntary disclosures, which means that it is believed that insiders have an information advantage about corporate disclosures and the information encompassed therein. Hence, information asymmetry augments managers' capability to take advantage of other shareholders with insider traders. Nonetheless, corporations with a high degree of information asymmetry deter prospective investors from engaging in trades with these corporations' insiders and so insider sales enclosing non-GAAP earnings disclosures allow insiders to circumvent negative abnormal returns. It is characteristic that insider trading takes place during a short window around audit report dates.[200]

Financial reporting transparency is central for outside investors to competently establish equity prices, particularly for MNEs due to the fact that as the global economy becomes more interconnected, regulators should continue to inspire MNEs to be transparent regarding exposure to risks linked with their foreign operations and sales. Well-functioning capital markets are vital to society, offering opportunities for individual investors to share in the benefits of prospering companies, and so investor confidence in the integrity of capital markets is spoiled if corporate insiders trade on material information unavailable to others. Managers' capability to trade profitably stems from their superior information over outside shareholders about key corporate events, embracing mergers and alterations in management teams and earnings announcements. To that extent, timely loss recognition (TLR) refers to the incremental timeliness with which accounting earnings acknowledge losses corresponding to profits, owing to the higher verifiability threshold for profit

recognition.[201] Hence, TLR lessens information asymmetry by diminishing insiders' information advantage regarding bad news, but not good news, limiting their possibility to circumvent losses by selling stocks prior to the revelation of bad news. On the other hand, TLR may have no impact on insider trading profitability since stock prices typically incorporate information faster than accounting earnings. Additionally, only nonroutine insider trades are informative about corporations' future performance, indicating that TLR diminishes private information imbedded in insiders' nonroutine trades. Even though TLR does not deter managers from insider trading, damages from insider trading are still slashed by TLR.[202] Also, Michael Tang and Hua (Christine) Xin[203] find that

> "the profitability of corporate insiders' trading decreases in the degree of asymmetric timely loss recognition (TLR) of their firms' financial reporting…reduced insider trading profitability is mainly driven by (a) stock sales, as opposed to purchases; (b) the price change component of trading, as opposed to its volume; and (c) insiders' nonroutine trades, as opposed to less information driven routine trades…TLR reduces managers' ability to extract rents from investors via insider trading."

5.11 Corruption and Insider Trading

It has to be taken into account that a corporation's corruption level affects the trading decisions of insiders, which means that insiders in a corporation that is more corrupt trade more aggressively and are more inclined to trade on their private information. Also, trade characteristics, insider characteristics, and the corporations' information environment are augmenting trade informativeness concerning both purchases and sales.

Moreover, corporate culture is affecting insiders' use of their private information when trading shares in their own corporations, which means that weak internal control over financial reporting denotes an absence of board integrity and multiplies insider trade informativeness. On the other hand, augmenting a corporation's spending on corporate social responsibility decreases insider trading informativeness and hampers the insider's trading behavior.[204] In other words, insiders in corporations that are more corrupt trade more, and the informativeness of their businesses is considerably strengthened due to the fact that insiders in corrupt corporations are using the information advantage that their access to private information gives them. To that extent, Kyriacos Kyriacou et al.[205] argue that "insiders in Chinese firms with higher levels of corporate corruption are more likely to use their private information when buying and selling their firm's shares."

It could be said that outside investors extracting the information encompassed in insider trading decisions have to look at the corporation's level of corruption as a quality that needs to be assimilated into their decision-making. In line, Kyriacos Kyriacou et al.[206] argue that

> "the post trade abnormal return following both insider purchases and insider sales is significantly related to the level of corruption within the firm. Our results demonstrate that insiders in more corrupt firms trade more aggressively, and are more likely to use their information advantage when trading. The symmetric nature of our results for purchases and sales implies that insider trading in Chinese firms is unaffected by the increased litigation risk that is normally assumed to be associated with sales as compared to purchases."

It is worth mentioning here that better governance urges the implementation of restrictions on insiders and thus averts them from trading on their private information, particularly concerning sales where there is considered to be a greater legal risk.

5.12 Governance and Insider Trading

Globalization brought new global governance mechanisms to which civil society and private actors, along with governments, contribute knowledge and capital. Global governance is the process by which the repertoire of norms and rules that drive the behavior of players in global affairs is ascertained, implemented, and restructured. Hence, globalization and global economic governance brought forward the interaction between governments and non-state actors as vital to the production of both positive global effects and the averting of negative outcomes. Governance specifies all regulations planned for the organization and centralization of human societies on a global scale. Moreover, governance conveys formal political institutions coordinating and controlling independent social relations, having the capacity to enforce, by force, their decisions.[207]

It has to be taken into account that corporate governance is a set of means through which outside investors protect themselves against expropriation by insiders. Effective corporate governance restricts managerial self-interest and protects shareholder interests while handling the interests of multiple stakeholders and settling the conflicts of interest between shareholders and non-investing stakeholders. To that extent, AI applications portray new types of scalable innovations in governance and institutional design. Beyond corporate governance,[208] the blockchain aids in instigating new decentralized models of commons-based management. Additionally, AI is shifting the balance of power, leading to a new era exemplified by global payment systems, digital assets, decentralized governance, and even decentralized legal systems, making possible collective organizations and social institutions to become more flexible, stimulating larger participation and possibly transforming how corporate governance and democratic institutions function.

Even though the IPO market is informationally efficient, when various corporations have different governance structures and outside investors are informationally disadvantaged compared to the insiders, the governance packages will be suboptimal, and so the incentive to take advantage of the informational advantage will be present.[209] Albert H. Choi[210] argues that

> "the IPO market is unlikely to provide the necessary discipline to incentivize companies to adopt the optimal governance package. In particular, when the optimal governance package differs across firms and there is an informational gap between the firms and the outside investors, the IPO market cannot accurately price governance provisions, and many firms will adopt a suboptimal governance structure."

It could be said that the IPO market will not run efficiently, offering the requisite incentive when different corporations have different sets of optimal governance features and outside IPO investors have less information than the founder-controller and other pre-IPO shareholders. Hence, AAI technology with automating control of data will harmonize IPO governance matters.

Do governance practices mitigate insider trading around the world? First of all, board reforms are key events shaping the efficacy of the corporate governance framework because the implementation of board reforms affects several corporate practices.[211] Moreover, board reforms are more effective in curbing insider trading activities in states with higher degrees of disclosure requests, corruption perception, and financial reporting quality. It must be taken into account that utilizing AI technology in the running of a company affects the board; thus, AI technology substitutes people, and the whole functioning of a company is conducted by AAI entities and so information is handled by the AI technology affecting insider trading opportunities.

It is characteristic that escalation in corporate transparency and quality monitoring or corporate governance lessens insider trading or the desirability of insiders to utilize their information advantage.[212] B. Godigbe and P. Akorsu[213] argue that

> "an average decrease in the profitability of purchase trades of insiders in firms mandated to increase their level of transparency (i.e. number and details of their reported operating business segments) due to SFAS 131 adoption… profitability of insider purchase trades increased after SFAS 131 adoption. Overall, this paper documents substantial information benefits of increased transparency in corporate reporting to outside investors, limiting insiders' information advantage in trading stocks of their own companies."

It has to be taken into account that private credit funds have a central role in the governance of a corporation and essentially have a dynamic role in the corporation's valuation. The supervising role of corporate boards and audit committees in deterring managerial self-dealing activities arising from agency problems between insiders and outside investors is vital. Boards of directors are responsible for ensuring that managers disclose value-relevant information in financial reports to prevent misinforming outside investors. Hence, corporate boards perform a central part in advancing checks and mitigating agency and information asymmetry problems. To that extent, board reforms are more successful in performing their supervising role in strong governance environments. In line with this, Hamdi Ben-Nasr[214] et al. argue that

> "firms with high information opacity experience a more pronounced decrease in bank debt ratio after the implementation of board reforms. This result suggests that the role of board governance reforms in enhancing monitoring and in substituting for bank debt is more visible in firms facing severe information problem…the adoption of board reforms improves the monitoring effectiveness of corporate boards and hence acts as a substitute for the need to bank-monitored debt."

Taking into account that broad governance reforms attract foreign institutional investors discouraging opportunistic insider trading, corporations imposing tighter insider trading restrictions pay a premium in total compensation levels and use higher incentive-based pay and equity enticements, in line with insider trading playing a role in both rewarding and motivating executives.[215] Moreover, executives exploit insider trading to offset the loss in compensation owing to missing relative performance goals, and so executives counterbalance increases in individual-level tax rates by participating in more profitable insider trades.[216] To that extent, Thomas Bourveau[217] et al. argue

> "that insiders may respond to this increased compensation risk by engaging in greater insider trading activity. Using the staggered adoption of say in pay across countries, we indeed find an increase in insider trading profitability. Cross-sectional tests indicate that the effect is more pronounced at firms whose executives are most negatively affected by the say on pay regime, i.e., firms with higher excess pay and weaker governance."

Also, taking into consideration that while political corruption is clearly against the law, political connections are legal. How does political corruption influence corporations' accounting choices? It could be said that corporations anticipate that the level of political corruption will be long-lasting, and they select income-decreasing accounting policies to generate a sustainable section between true earnings and reported numbers. It seems that corporations maneuver earnings downwards to shield their assets from expropriation by public officials, demarcating the influence of political corruption on corporations' accounting choices; thus, corporations respond to corruption by lowering their accounting earnings. To that extent, Huai Zhang and Jin Zhang[218] argue that

> "the impact of corruption is less pronounced for firms with political connections, because political connections offer protections against expropriations by local government officials. Next, we predict that the effect of political corruption is more pronounced for firms in politically sensitive industries, because these firms are easy targets for corrupt rent-seeking officials. Last, we predict that the impact of corruption is less pronounced for firms with higher transient institutional investor ownership or greater analyst coverage, as they are faced with greater pressure on near-term earnings."

The financial stability of corporations is a concern to many agents in society, including investors, bankers, governmental and regulatory bodies, and auditors, which means that the responsibility of government and regulatory authorities is to supervise the general financial status of corporations in order to make proper economic and industrial policy.

It has to be taken into consideration that corporate governance encloses corporations' direction and control and so identifying distribution of rights and responsibilities among various contributors within the corporation and a corporate structure that includes the Board, Managers, Shareholders, and other Stakeholders. Furthermore, the structure denotes the rules and procedures for making decisions on corporate affairs, which indicates the significance of corporate governance, particularly for gaining investor confidence for the appropriate running of the corporation.

Actually, the purpose of an effective risk assessment course is to categorize coverage gaps and advance plans to remediate coverage shortages before they are uncovered. Hence, the corporate board has multi-dimensional tasks in driving top management toward the right risk choices, which means that the board supervises the risk situation of the corporation thoroughly to recognize and assess multiple sources of risk and, therefore, risk respected with the intention of appreciating an asset or appraising the performance of an investment.

AI-driven financial systems necessitate robust risk assessment and stress-testing frameworks adapted to the intricacy, compliance, and opacity of machine learning models. Thus, the operational risk background has to integrate both ex-ante analysis and real-time checking to reveal vulnerabilities such as overfitting, data drift, and adversarial inputs, along with stress-testing under diverse market conditions encompassing liquidity, volatility, and linked asset failures, allowing the detection of hidden risks before they rise into systemic interferences.

Risk assessment via AAI technology has to be interactive and cross-disciplinary in upholding failures and systemic contagion initiated by self-directed financial agents. Market shocks, liquidity crises, and functioning failures are testing AI competence under coercion. AI surveillance frameworks engage dynamic network analysis to detect systemic fragility and seize the real-time transmission of shocks across financial markets, which means empowering early-warning processes that offer early visualizations of progressing trading patterns to detect the required intervention before market disruptions intensify.

5.13 Corporate Social Responsibility (CSR) and Insider Trading

Corporate social responsibility (CSR) has become an imperative strategic decision in present management practices. CSR enables corporations to build good relations with employees, suppliers, customers, and the government, and so these relationships advance shareholder value. Besides, insiders exploit their information advantage and deviously trade their stocks to make abnormal profits at the cost of shareholders, even under strict regulations. To that extent, Tao Li[219] et al. find that

> "CSR is positively associated with insider trading profitability, especially insider sale profitability, which indicates that insiders tend to reap private benefits from CSR…the positive relation between CSR and insider trading profitability is more significant before the regulator strengthens its supervision of insider trading, and that this positive relation is weakened by the nature of state-owned enterprises (SOEs), institutional ownership, and analyst coverage."

It has to be taken into consideration that CSR has become a business activity influencing corporations' internal corporate governance. Have CSR-aligned executives embraced higher ethical standards and limited their manipulation of private information? First of all, it seems that CSR's ethical influence is not a panacea for diminishing corporate insider profits.[220] CSR is an externality to the corporation through a "doing well by doing good" strategy that improves reputation and delivers positive economic results; thus, the CSR agenda further protects the brand. Moreover, a corporation engages in CSR in order to lessen either existing or expected adverse outcomes from other business activities.[221] Also, CSR commitment is connected with increased corporate governance, greater information transparency, and internal monitoring. Hence, CSR governance is correlated with higher financial accounting quality, lower manipulations, and GAAP violations, which means that CSR-committed corporations are less likely to be subject to SEC investigations,[222] and so corporations enforce restraints on insider trading. To that extent, countries embrace fairly stricter insider trading regulations in order to protect investors and promote market development.[223] Likewise, Sophie Carran[224] et al. argue that

> "higher commitment to CSR did not negate the weaker legislation and corporate board cultures in Continental Europe in restricting opportunities for insider expropriation…In short, an established business nature that tends to focus on internalising the interests of outsider stakeholders and large controlling shareholders, at the expense of minority shareholders…is associated with higher insider rent extraction…weak shareholder protection and countrywide governance codes enable the inherent nature of insiders to extract profits and to dominate any ethical constraining influence of CSR commitment."

5.14 AI and Money Laundering

Anti-money laundering regulations are not restricted to financial institutions, as other non-financial regulated businesses are also compelled by law to prevent money laundering and terrorist financing. Compliance AI is exemplified by dynamic and automated client risk assessment for banks, and AI is being deployed to combat money laundering by automating customer due diligence.[225]

Money laundering undercuts the integrity of financial institutions, undermines control over national economic policies, generates investment uncertainty leading

to a disrupted economy, and shrinks government tax income. Furthermore, money laundering[226] accomplishes an illegal monetary function, reacting to the demand for black finance services expressed by individuals or groups that have performed income-producing crimes. In line, Karen Harrison and Nicholas Ryder[227] define money laundering as "the process utilized by criminals to disguise or convert the proceeds of crime (dirty money) into clean money." Moreover, money laundering is a serious threat to the global financial system, enabling illegal activities by destabilizing the integrity of the financial system, and so many countries have employed strict regulations to combat money laundering, and some countries have even barred certain financial transactions altogether. Money laundering destabilizes the integrity of financial markets. While large sums of laundered money arrive at institutions, they disappear instantly, producing liquidity problems. Moreover, governments lose revenue due to money laundering, which means that money laundering reduces tax revenue and often entails higher tax rates for other honest citizens.

Has crypto-laundering surfaced in the global market? Unlike "fiat" currencies that are used as legal tender and the principal medium of exchange by issuing countries, virtual currencies are stateless and intangible and to that extent, Bitcoin seems to be the most popular cryptocurrency used in ML schemes. Additionally, Bitcoin is common among crypto-money launderers, even though most use some form of altcoin along with the use of third-party currency exchanges as a widespread method to conceal proceeds of crime. Moreover, both owners of exchanges and independent money launderers are utilizing exchanges for proceeds of crime, irrespective of regulation.

The technology ensures greater anonymity than traditional financial mechanisms, and so the appearance of crypto-laundering tests the flexibility and adaptability of AML rules. Not to mention that the use of multiple currencies differentiates the illicit funds, which makes them harder to uncover. Christian Leuprecht[228] et al. argue that "the cause of cryptocurrency's vulnerability to financial crime…currency exchanges and regulation more widely are to blame, rather than the technology itself."

It has to be taken into consideration that the appearance of new information concerning crypto assets and e-money generates a new zone for money laundering. Hence, AI technology contributes to identifying movements regarding e-money circulation and spotting abnormal activities of crypto assets plus conventional money circulation utilized by participants in all kinds of markets. On the other hand, AI systems might conceal money laundering due to its electronic character and the electronic convertibility of crypto assets into fiat currencies. Zekos argues that the development of AAI technology functioned by AAI entities in objectively running AAI markets will spot money laundering in all types of crypto assets via automatic and autonomous decision-making because the whole systems will be controlled from the entry of any e-data in the systems and the market and the actions and profits of any legal entity.

Specifically, the rise of AI algorithmic trading and its disruptive prospects for market integrity call into question the EU financial law's capability to credibly prevent AI-driven market manipulation. AI trading subjects EU capital markets'

integrity to new and emerging risks of algorithmic market manipulation. It is expected that the introduction of AAI technology will eliminate market manipulation due to its technical capacities to spot every electronic transaction immediately and warn the AAI systems of the irregularity before committing any financial crime.

Money laundering is a threat to financial stability, for the reason that it changes the functioning of financial markets to the advantage of operators who are colluding with organized crime. Moreover, money laundering transforms the proceeds of crime into legitimate assets, thereby escalating the degree of penetration of the legal sector by criminal organizations and assisting diversification of criminals' income and wealth.[229] Raymond Baker[230] used US Treasury Department statistics on illicit money flows and money laundering conviction rates to expose that US law enforcement agencies failed to apprehend money launderers 99.9 percent of the time. In line with this, the United Nations assesses the global percentage at 99.8 percent.[231]

AI assists financial compliance which means that automated systems scrutinize transactions for their compliance with the laws of KYC and AML. On the other hand, owing to technology developments running ahead of the legislative process, it is still quite difficult to create AI-specific financial regulations and only via technology devices defense against illegality is achieved quite properly in battling crimes. The flexibility of money laundering techniques and the persistent pace of technological innovation mean that governance structures cannot achieve full efficacy.

It has to be considered that digitization generates new and innovative opportunities; on the other hand, it makes users and society vulnerable to cyberattacks, which means that the forceful character of IT technology is echoed in the ever-changing threats, whose volatile nature forces authorities and firms to amend their cybersecurity measures and level of readiness, not to mention the new ways of money laundering, market abuse, and insider trading. Thus, economic analysis of the phenomena of insider trading and money laundering has to take place prior to the endorsement of legislation regulating the minimization of the two phenomena, which has to be followed by an effective enforcement system. The eradication of the phenomena cannot be achieved, but the existence of a low level of insider trading and money laundering could be inspiring for the operability of the market and international entrepreneurs, together with politics.

AI technological advances have altered the markets, escalating the prospective reach of manipulative conduct, and so the financial markets have become faster and more computerized, which means that AI algorithms implement a high volume of transactions within a fraction of a second. Most algorithmic trading programs are designed to exploit arbitrage opportunities in the markets, profiting from small discrepancies in asset prices, which is only achievable as a strategy if done over thousands of trades. Another crucial characteristic of trading in the digital market is the speed with which algorithms execute transactions, which means that this speed is indispensable to the profitability of algorithmic trading programs. Thus, by trading quicker than competitors, traders in modern-day markets are able to profit. On the one hand, the incorporation of AI into algorithmic trading systems has altered financial markets, empowering faster, data-driven decision-making and

the automation of multiple trading strategies in order to gain financial market stability.[232] On the other hand, whereas AI-driven algorithmic trading augments market productivity and execution speed, it also establishes new dimensions of market liquidity risk and systemic vulnerabilities.

It is worth noting here that the advancement of computing power has been the central driver of the digital economy's growth, and so, the advancement of AI technology promotes the AI economy functioning via AAI humanoids, which will conquer the earth and probably utilize humans as their slaves. Will AAI humanoids be spiritually higher entities? It is supposed that the AAI humanoids' brains will have higher qualities in comparison to humans' brain so as to function at higher levels of spiritualty in order AAI society can be a better one in relation to the present spirituality of humans' society. Zekos considers that if AAI humanoids have the capacity to function in both the material world and the spiritual dimension of existence, it will be the turning point in transforming the existence of another type of life that is closer to the spiritual life of humans after death, according to Christianity, thus coming nearer to the "descriptions" of Greek mythology, which might had been a reality a long time ago as well.

Finally, AI technology is a new weapon in the hands of the market to combat insider trading and money laundering due to its capacity to detect unusual activities and make inside information publicly available quickly, thereby disallowing the contact of any financial crime based on unknown information. On the other hand, AI systems are weapons in the hands of insiders to quickly conduct electronic transactions and conceal insider trading and money laundering. Besides, the advancement of AAI technology functioning objectively will eliminate financial crimes by making autonomous AAI decisions based on all the information entered into the AAI systems and automatically spotting any insider trading and money laundering. Additionally, all new information will become publicly available automatically, leaving any ground for financial crimes such as insider trading and money laundering.

Has AI laundering emerged in digital markets? AI will be utilized in new money laundering methods that are less detectable and so AI laundering introduces an increased layer of anonymity, which means utilizing analog online services, credit cards, prepaid cards, online gambling, etc. Another mechanism for cyber laundering is the transfer of digital ownership of items, such as the transfer of digital ownership of commodities and precious metals. To that extent, cyberspace and AI systems facilitate the transfer of ownership from individual to individual without the requirement to physically have the item on hand, allowing any item to be used as an alternative to direct cash transfer. Additionally, crypto assets such as cryptocurrencies, and NFTs are used to aid in money laundering activities due to their increased speed, profit, and decreased detection risk. It must be taken into account that the amplified capability to form multifaceted webs of transactions by energizing complex audit trails is a new element, and the risk linked to the detection of cyber laundering is exceedingly diminished compared to traditional methods.

It is worth noting that video games offer an opening to criminals, permitting easier and less detectable methods to perform money laundering actions. In line with this, Daniel Cooke and Angus M. Marshall[233] argue that

> "you can identify using very simple money laundering detection methods possible cases of money laundering within transactional data from the Steam Marketplace. This data showed that there were several suspicious transactions and accounts that would warrant further investigation and may end up constituting money laundering."

The competence in generating unlimited accounts to an extent that makes it impracticable to supervise transactions, the likelihood of person-to-person transfers through crypto asset exchanges, and the capability to camouflage financial activities are reasons that make crypto assets a preferred device for laundering. Hence, the utilization of crypto assets in the laundering process makes even more complex to track money laundering, and so, criminals employ crypto asset tumblers and mixing services to disguise the roots of their illicit gains, making harder and costly the tracing of the flow of money and spotting the architects of ML. It has to be taken into account that "The obligations imposed on crypto asset service providers include customer identification, reporting suspicious transactions, providing information and documents, continuous reporting, and record retention and submission,"[234] and they are considered as factors prohibiting ML.

It could be argued that CBDC systems have to avoid threats to the existing safeguards and establish AML/CFT competencies in multi-stakeholder systems, which means that in the case of CBDCs, there is a need for utilizing the monitoring of the whole system in order to combat money laundering, terrorist financing, and tax evasion.[235] It has to be taken into account that Fed Accounts deal with physical currency that is maintained and monitored by the central bank, and so any CBDC, such as the digital dollar, has to be handled by Fed Accounts as well. Jiaying Jiang[236] argues that

> "if the digital dollar adopts these privacy-preserving designs, it will directly conflict with existing anti-money laundering and countering the financing of terrorism (AML/CFT) regulations that require transparent data to combat financial crimes…changes to financial institutions' record-keeping and reporting practices…modernizing AML/CFT requirements to allow a certain degree of anonymity to protect privacy while still fulfilling public interest objectives such as combating money laundering and terrorist financing."

On the other hand, by giving access to payment data not only to regulatory and supervisory bodies but also to private actors, the risk is expanded by the prospect of CBDCs to intrude into the private lives of individuals via payment history datasets produced by commercial payments platforms. To that extent, P. Michalopoulos et al.[237] argue that

> "supporting offline transactions introduces additional degrees of freedom to the privacy design options of CBDCs. A fully offline CBDC appears to maximize privacy but compromises transaction monitoring and other essential risk management approaches. On the other hand, different flavors of online CBDCs with support for offline transactions essentially offer the same spectrum of privacy as fully online solutions, from full transparency to cash-like privacy."

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6 Econometric Analysis of the Impact of Competition, Exports, and Trade Upon AI Economy

6.1 Introduction

Digitalization has accelerated a modification in market dynamics, elevating the emergence of key platforms, networks, and, thus, the growth and evolution of the digital economy, lifting competition enforcement challenges. Hence, competition enforcers must confront the intricacy of running their assessments in a digital environment and so, generating uncertainty as to the nature of competitive pressures and the ability of markets to self-correct.

It is worth mentioning here that freedom of competition covers the freedom of companies to choose their action parameters, besides market power, which might impede both freedom of choice between different suppliers and the freedom to decide on companies' action parameters in competition with other companies. Competition law has to take into account the effects of restrictive agreements, mergers, and business behavior on consumer welfare and also on a set of protected rights of competitors, which might undergo losses through the infringement of these rights.

It is characteristic that antitrust laws protect forceful competition in the marketplace, while intellectual property laws protect the ability to receive a return on the investments needed to innovate. Both impel competition among competitors to be the first to enter the marketplace with a needed technology, product, or service. While IP law expressly subjects intellectual assets to the sole control of right owners, competition law seeks to preclude market barriers benefiting consumers by advancing competition among a multiplicity of suppliers of goods, services, and technologies.

Even AI technology, being an instrument in the hands of humans, has not advanced competition due to an objective applicability, which means that AI has to get autonomous and independent applicability in order to achieve objectivity in fulfilling its purposes. It is worth noting that, in the United States, the HJC Report[1] concluded that the four "Big Tech" firms had gained and solidified dominant positions through anticompetitive conduct. The limited monopolies established by IPRs are not per se anticompetitive or very exploitative, but they only turn anticompetitive when the IPR holder broadens those rights further than their intended and proper scope. The interface between IPRs and competition law has developed a number of types of restraints on competition, making very complex the relation between IPR and competition.

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Courts utilize a case-by-case approach to assess claims of anticompetitive behavior rather than per se/ex ante rules needing only interpretation, and thus antitrust investigations and litigation are time-consuming, expensive, and very often contradictory judgments.[2]

The digital revolution has brought forward protests that Big Tech companies gained monopolization not via superior products and good management but merely by prohibiting the entrance of other competitors and so generating a problem and should do something about it.[3]

The rise of AI technologies has transformed international trade, advancing new possibilities for businesses to grow into global markets through e-commerce and e-export. Above all, e-export, which includes cross-border electronic transactions, has become a decisive path for businesses. The course of goods and services across borders, enabled by digital platforms, has allowed corporations to reach global audiences, which means that e-export and e-commerce let businesses to overcome geographical barriers, empowering them to present products and services via digital platforms and thus facilitating real-time engagement with customers streaming demand for e-export.[4] Also, e-export allows corporations to reach international customers without being restricted by time zones or geographical restrictions. In other words, e-logistics, regulatory compliance, and customs clearance offer digital transactions for clients throughout the globe.

6.2 Methodology and Data

A large sample of 79 countries has been assembled for Zekos' research[5] in producing IPR indexes. All the national laws in force at the end of 2012 of the 79 investigated jurisdictions have been examined and used in the ranking of the various factors taken into account in constructing the indexes ZEKIPR6,[6] ZEKIPR7, ZEKIPR8, and ZEKIPR9.[7] It is worth mentioning that the construction of our IPR indices relies on: (a) membership in IPR international treaties, (b) patent rights, (c) copyrights, (d) trademark rights, and (e) legal system and property rights rating (rank) of countries.

In other words, all the national laws in force by the end of 2012 of the 79 investigated jurisdictions have been examined and used in the ranking of the various factors taken into account in constructing the following Indexes:

ZEKIPR6 = Membership in International Treaties + INDEX OF PATENT RIGHTS + INDEX OF COPYRIGHT + INDEX OF TRADE-MARK RIGHTS + Enforcement legal rating (Legal Tradition (Rule of law) + Legal Education + Economic level)

ZEKIPR7 = Membership in International Treaties + INDEX OF PATENT RIGHTS + INDEX OF COPYRIGHT + INDEX OF TRADE-MARK RIGHTS + Enforcement rating ((Legal and Political Environment (LP) (Judicial Independence + Rule of Law + Political Stability + Control of Corruption) (International Property Rights Index | 2012 Report))

ZEKIPR8 = Membership in International Treaties + INDEX OF PATENT RIGHTS + INDEX OF COPYRIGHT + INDEX OF TRADE-MARK RIGHTS +

Enforcement rating ((Legal and Political Environment (LP) (Judicial Independence + Rule of Law + Political Stability + Control of Corruption) (International Property Rights Index| 2014 Report)). It is worth mentioning that some countries are not contained in 2014 IPRI and so their ranks are taken from 2013 IPRI.

ZEKIPR9 = Membership in International Treaties + INDEX OF PATENT RIGHTS + INDEX OF COPYRIGHT + INDEX OF TRADE-MARK RIGHTS + Legal System and Property Rights Rating (Rank) of countries (Economic Freedom of the World: 2014 Annual Report, Area Economic Freedom Ratings (Rankings) for 2012)

A linear model is in the form

$$Y_i = \beta_0 + \sum_{j=1}^{p} \beta_j X_{i,j} + \varepsilon_i, \tag{1}$$

where, for the *i*th case, Y_i is the response variables , $X_{i,1,}\ldots,X_{i,p}$ are *p* regressors, and ε_1 is a mean zero error term. The quantities $\beta_0,\ldots,\beta_p$ are unknown coefficients, whose values are determined by least squares.

In detail, the following are the econometric models that are used in our investigation in order to find the impact of IPRs, GDP growth, GDP, trade, and inflation upon attracting FDI inflows, the role of exports, and impact upon GDP.

$$FDI_{it} = b_0 + b_1 \text{Zekipr6/ zekipr7/ zekipr8/ zekipr9}_{it} + b_2 GDP_{it} + b_3 Trade_{it} + b_4 Inflation_{it} + u_{it} \tag{1}$$

$$FDI_{it} = b_0 + b_1 GCI_{it} + b_2 GDP_{it}/ (\text{GDPc}_{it}) + b_3 Trade_{it} + b_4 Inflation_{it} + u_{it} \tag{2}$$

$$FDI_{it} = b_0 + b_1 zekipr8_{it} + b_2 GDP_{it} + b_3 Trade_{it} + b_4 Inflation_{it} + u_{it} \tag{3}$$

$$GDP_{it} / (\text{GDPc}_{it}) = b_0 + b_1 zekipr8_{it} + b_2 Trade_{it} + b_3 Inflation_{it} + b_4 FDI_{it} + u_{it} \tag{4}$$

$$\text{EX}_{it} = b_0 + b_1 zekipr8_{it} + b_2 Trade_{it} + b_3 GDP_{it} + b_4 Inflation_{it} + u_{it} \tag{5}$$

$$\text{EX}_{it} = b_0 + b_1 zekipr8_{it} + b_2 Trade_{it} + b_3 FDI_{it} + b_4 Inflation_{it} + u_{it} \tag{6}$$

$$FDI_{it} = b_0 + b_1 GCI12_{it} + b_2 Trade_{it} + b_3 Inflation_{it} + b_4 GDPGR_{it} + u_{it} \tag{7}$$

6.3 Linear Empirical Results

The analysis of the data utilizing our econometric models gives the following results:

6.3.1 FDI Inflows OLS Model 1 Beta Coefficients

We carry on our investigation with model 1[$FDI_{it} = b_0 + b_1$ Zekipr6/ zekipr7/ zekipr8/ zekipr9$_{it} + b_2 GDP_{it} + b_3 Trade_{it} + b_4 Inflation_{it} + u_{it}$] using OLS standardized

coefficients or beta coefficients, and the results (Coef. 2.55**, 2.11*, 2.10*, 2.06*) show the significance of Zekipr6/ zekipr7/ zekipr8/ zekipr9 for the 2012 reference regarding foreign direct investment, net inflows US Dollars at current prices and current exchange rates in millions 2012 UNCTADstat (Table 6.1). It is worth mentioning here that the Zekipr6/ zekipr7/ zekipr8/ zekipr9 beta regarding FDI inflows are (.5898402, .4982552, .4907957, .4411349) respectively.

We maintain our investigation with models 2 and 3 [$FDI_{it} = b_0 + b_1 GCI_{it} + b_2 GDPit/(\text{GDPc}_{it}) + b_3 Trade_{it} + b_4 Inflation_{it} + u_{it}$ / $FDI_{it} = b_0 + b_1 zekipr8_{it} + b_2 GDP_{it} + b_3 Trade_{it} + b_4 Inflation_{it} + u_{it}$] using OLS standardized coefficients or beta coefficients utilizing GDP per capita growth (annual%) / GDP growth (annual%) and the results (Coef. −2.37, −0.62/ −1.97, −0.50) show the significance of GCI 2014 for the 2013 and five-years reference regarding foreign direct investment, net inflows (% of GDP). It is worth mentioning here that the GCI 2014 betas regarding FDI are (.0837217, −.0288108). Table 6.2 shows the significance of both GCI and zekipe8 concerning Foreign direct investment, net inflows (% of GDP) by utilizing GDP per capita growth (annual%).

6.3.2 GDP OLS Model 4 Beta Coefficients

We get going our investigation with model 4 [$GDP_{it}/(\text{GDPc}_{it}) = b_0 + b_1 zekipr8_{it} + b_2 Trade_{it} + b_3 Inflation_{it} + b_4 FDI_{it} + u_{it}$] using OLS standardized coefficients or beta

Table 6.1 FDI inflows OLS model 1 beta coefficients

	(1)	*(2)*	*(3)*	*(4)*
VARIABLES	logfdiin2012	logfdiin2012	logfdiin2012	logfdiin2012
zekipr7	2.11*			
	(0.800)			
gdpgr2012	0.06	0.10	0.06	0.04
	(0.075)	(0.076)	(0.074)	(0.075)
trade2012	0.00	0.00	0.00	0.00
	(0.003)	(0.003)	(0.003)	(0.003)
inf2012	0.02	0.03	0.02	0.02
	(0.066)	(0.065)	(0.066)	(0.071)
zekipr6		2.55**		
		(0.811)		
zekipr8			2.10*	
			(0.797)	
zekipr9				2.06*
				(0.916)
Constant	0.07	−2.03	0.11	0.18
	(3.306)	(3.441)	(3.300)	(3.822)
Observations	52	52	52	52
R-squared	0.18	0.22	0.18	0.15
Adj. R-squared	0.11	0.16	0.11	0.08

Author created. Standard errors in parentheses.
***p<0.001, **p<0.01, *p<0.05.

Table 6.2 FDI inflows OLS model 2/model 3 beta coefficients

	(1)	*(2)*	*(3)*	*(4)*
VARIABLES	fdiin2013	fdiin5y	fdiin2013	fdiin5y
c2014	−2.37	–0.62		
	(1.554)	(2.584)		
gdpc2013	0.29		0.16	
	(0.372)		(0.416)	
tr2013	0.08***		0.08***	
	(0.014)		(0.014)	
inf2013	0.10		0.14	
	(0.328)		(0.323)	
gdpc5y		−0.05		0.01
		(0.551)		(0.638)
tr5		0.15***		0.14***
		(0.023)		(0.023)
inf5y		0.25		0.32
		(0.301)		(0.311)
zekipr8			−4.06	0.87
			(3.050)	(5.447)
Constant	6.47	−6.51	11.76	−12.93
	(7.513)	(12.346)	(12.430)	(22.343)
Observations	71	77	71	77
R-squared	0.34	0.36	0.34	0.36
Adj. R-squared	0.30	0.33	0.30	0.33

Author created. Standard errors in parentheses.

***p<0.001, **p<0.01, *p<0.05.

coefficients utilizing variable FDI inflows (net inflows (BoP, current US$)) and the results (Coef. −5.71***, −6.79***/1.37***, 1.30**) show the significance of zekipr8 for the 2013 and five-years reference regarding GDP growth (annual%)/ GDP (constant 2005 US$) (Table 6.3). It is worth mentioning here that the zekipr8 betas regarding GDP are (−.6945353, −.8025859/, .2528317, .2474103).

6.3.3 Exports of Goods and Services OLS Model 5/Model 6 Beta Coefficients

We get going our investigation with Model 5/model 6 [$EX_{it} = b_0 + b_1 zekipr8_{it} + b_2 Trade_{it} + b_3 GDP_{it} + b_4 Inflation_{it} + u_{it}$ / $EX_{it} = b_0 + b_1 zekipr8_{it} + b_2 Trade_{it} + b_3 FDI_{it} + b_4 Inflation_{it} + u_{it}$] using OLS standardized coefficients or beta coefficients utilizing variables GDP growth (annual%), foreign direct investment, net inflows (% of GDP), and the results (Coef. 5.18*, 3.53/3.90*, 3.02) show the significance zekipr8 for 2013 and five-years reference regarding exports of goods and services (% of GDP) (Table 6.4). It is worth mentioning here that the zekipr8 beta regarding FDI inflows are (.0544602, .0396849/.0409306, .034006).

Table 6.3 GDP OLS model 4 beta coefficients

	(1)	*(2)*	*(3)*	*(4)*
VARIABLES	gdp2013	gdp5y	loggdpl2013	loggdpl5y
zekipr8	−5.71***	−6.79***	1.37***	1.30**
	(0.947)	(0.994)	(0.386)	(0.426)
tr2013	0.00		−0.01***	
	(0.005)		(0.002)	
logfdiif2013	0.12		0.81***	
	(0.176)		(0.071)	
inf2013	0.02		−0.05	
	(0.087)		(0.036)	
logfdiif5y		0.51**		0.76***
		(0.152)		(0.065)
tr5		0.00		−0.01***
		(0.005)		(0.002)
inf5y		−0.02		−0.00
		(0.060)		(0.026)
Constant	21.87***	16.84***	3.47	4.51*
	(4.375)	(4.314)	(1.780)	(1.850)
Observations	64	76	64	76
R-squared	0.45	0.51	0.79	0.77
Adj. R-squared	0.41	0.49	0.78	0.76

Author created. Standard errors in parentheses.

***p<0.001, **p<0.01, *p<0.05.

6.3.4 FDI Inflows OLS Model 7 Beta Coefficients

FDI represents: GDP GR 2012 = GDP growth (annual%) 2012 World Bank, INF2012 = Inflation, consumer prices (annual%), 2012 World Bank, TRADE2012 = Trade (% of GDP), 2012 World Bank, GCI. Using the Global Competitiveness Index 2011–2012 (GCI) are the explanatory variables.

We start our investigation with model 7 [$FDI_{it} = b_0 + b_1 GCI12_{it} + b_2 Trade_{it} + b_3 Inflation_{it} + b_4 GDPGR_{it} + u_{it}$] using OLS standardized coefficients or beta coefficients, and the results show that *GCI*12 is significant (Coef. 1.87***, 1.82***, 2.06***) regarding 10, 5 years average and 2012 reference concerning FDI inflows under standardized variables (Table 6.5). It is worth mentioning here that the gci beta regarding FDI inflows are (.7735433, .721484, .723533) respectively.

The following avplots (graphs an added-variable plot, a.k.a. partial regression plot) illustrate the econometric outcomes (see Figure 6.1):

```
reg logfdiin2012 gci12 gdpgr2012 trade2012 inf2012, beta
```

Table 6.4 Exports of goods and services OLS model 5/model 6 beta coefficients

	(1)	*(2)*	*(3)*	*(4)*
VARIABLES	ex2013	ex5y	ex2013	ex5y
zekipr8	5.18*	3.53	3.90*	3.02
	(2.134)	(2.452)	(1.706)	(2.005)
tr2013	0.54***		0.53***	
	(0.009)		(0.011)	
gdp2013	0.28			
	(0.250)			
inf2013	−0.04		−0.04	
	(0.172)		(0.173)	
gdp5y		0.08		
		(0.241)		
tr5		0.54***		0.53***
		(0.010)		(0.012)
inf5y		0.05		0.03
		(0.131)		(0.131)
fdiin2013			0.05	
			(0.078)	
fdiin5y				0.06
				(0.050)
Constant	−24.10**	−17.57	−18.26**	−14.89
	(8.775)	(10.086)	(6.704)	(8.192)
Observations	72	78	72	78
R-squared	0.98	0.98	0.98	0.98
Adj. R-squared	0.98	0.98	0.98	0.98

Author created. Standard errors in parentheses.

***p<0.001, **p<0.01, *p<0.05.

6.4 Non-Linear Empirical Results

Table 6.6 shows the value of *zekipr8*, which will be utilized in our non-linear investigation.

6.4.1 FDI Inflows OLS Model 3/Zekipr8 25%/75%, Beta Coefficients

We prolong our analysis by utilizing a non-linear investigation with model 3 [$\boldsymbol{FDI_{it} = b_0 + b_1 zekipr8_{it} + b_2 GDP_{it} + b_3 Trade_{it} + b_4 Inflation_{it} + u_{it}}$] using OLS standardized coefficients or beta coefficients and the results show that zekipr8 for a value of zekipr8 <25%/>25% (Coef. 4.74, 4.12***) and for a value of zekipr8 <75%/>75% (Coef. 3.32**, 3.34) in reference to FDI inflows for five years regarding foreign direct investment, net inflows (BoP, current US$) (Table 6.7). It is worth mentioning here that the zekipr8 betas regarding FDI are (0.4785156, 0.5530278/0.5813996, 0.196566). It is worth mentioning that it becomes clear the significance of the level

Table 6.5 FDI inflows OLS model 7 beta coefficients

	−4	*−5*	*−6*
VARIABLES	*logfdiin2012*	*logfdiin5y*	*logfdiin10y*
gdpgr2012	−0.02		
	−0.054		
trade2012	0		
	−0.003		
inf2012	0.07		
	−0.055		
gdpgr5y		0.09	
		−0.055	
trade5y		0	
		−0.003	
inf5y		0.03	
		−0.05	
gdpgr10y			0.04
			−0.058
trade10y			−0.01*
			−0.002
inf10y			0
			0
gci12	2.06***	1.82***	1.87***
	−0.379	−0.328	−0.244
Constant	−0.54	0.45	0.53
	−1.747	−1.648	−1.173
Observations	52	76	79
R-squared	0.42	0.39	0.51
Adj. R-squared	0.37	0.36	0.48

Author created. Standard errors in parentheses.

***p<0.001, **p<0.01, *p<0.05.

of IPR protection. In fact, a value of zekipr8 >25% and <75% indicates a higher significance of zekipr8 regarding Foreign direct investment, net inflows.

The following avplot—graphs an added-variable plot, a.k.a. partial regression plot—shows the value of the variables in the econometric model (see Figure 6.2).

```
reg logfdiif5y zekipr8 gdp5y tr5 inf5y if zekipr875==0,beta
```

6.4.2 GDP OLS Model 4/Zekipr8 25%/75%, Beta Coefficients

We maintain our investigation with model 4 [$\boldsymbol{GDP_{it} / (GDPc_{it}) = b_0 + b_1\ zekipr8_{it} + b_2\ Trade_{it} + b_3\ Inflation_{it} + b_4\ FDI_{it} + u_{it}}$] using OLS standardized coefficients or beta coefficients and the results show that zekipr8 for a value of zekipr8 < 25% / > 25% (Coef. 2.79, -4.56***) and for a value of zekipr8 <75%/>75% (Coef. −5.84***, −0.97) reference GDP 2013 regarding GDP growth (annual%)

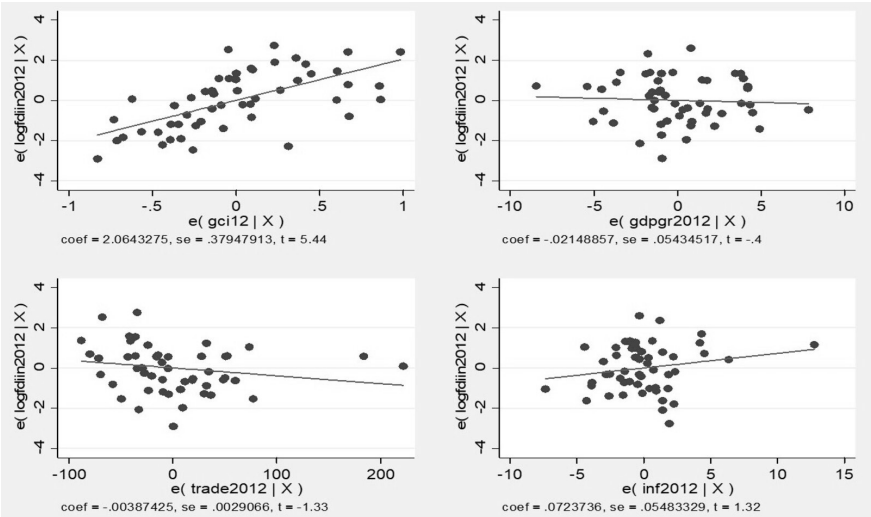

Figure 6.1 —FDI inflows OLS—avplots.

Table 6.6 Variable regression collinearity

Summarize zekipr8, detail				
Zekipr8				
	Percentiles	Smallest		
1%	3.117291	3.117291		
5%	3.205313	64.598 pt		
10%	3.314236	3.199026	Obs	79
25%	3.583221	3.205313	Sum of Wgt	79
50%	3.909432		Mean	3.855228
		Largest	Std. Dev	0.3582848
75%	4.150887	4.39352		
90%	4.318841	4.399541	Variance	0.128368
95%	4.39352	4.498397	Skewness	−0.2367334
99%	4.5082	4.5082	Kurtosis	2.103713

(Table 6.8). It is worth mentioning here that the zekipr8 betas regarding GDP are (.1156173, −.5343904/, −.5869348, −.0746927).

6.5 Conclusions

IPRs legal regulation grows as technology develops to accomplish an adequate balance between private rights and public interests. The existing legal environment does not offer sufficient protection in the changing technological environment, but there is a need to go on with supporting technological advancement while protecting users' data and interests. Now technology is changing at a faster pace than the

Table 6.7 FDI inflows OLS model 3/zekipr8 25%/75%, beta coefficients

	(1)	*(2)*	*(3)*	*(4)*
VARIABLES	logfdiif5y	logfdiif5y	logfdiif5y	logfdiif5y
zekipr8	4.74	4.12***	3.32**	3.34
	(3.190)	(1.081)	(1.120)	(4.644)
gdp5y	−0.08	0.40***	0.24**	0.73
	(0.163)	(0.101)	(0.083)	(0.433)
tr5	−0.01	−0.00	−0.00	−0.00
	(0.011)	(0.003)	(0.004)	(0.007)
inf5y	0.04	0.03	0.03	0.27
	(0.056)	(0.096)	(0.045)	(0.553)
Constant	5.91	5.69	9.02*	8.69
	(10.901)	(4.500)	(4.389)	(20.280)
Observations	19	57	58	18
R-squared	0.15	0.30	0.17	0.27
Adj. R-squared	−0.10	0.24	0.11	0.04

Author created. Standard errors in parentheses.

*** p<0.001, ** p<0.01, * p<0.05.

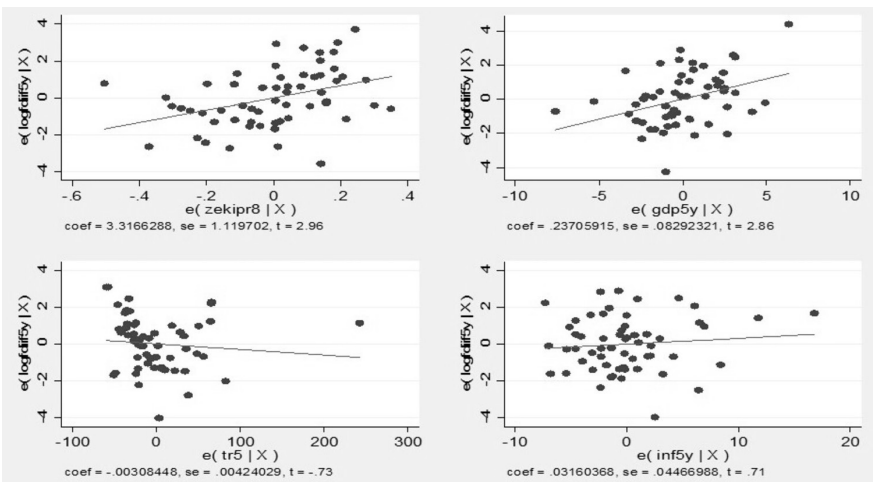

Figure 6.2 FDI inflows OLS—avplots.

development of law and the rule of law, which means that this failure is reflected in IPRs regulation. Competition is a vital factor regarding industry value and so utilizing the econometric models finds that competition is a significant factor in attracting FDI.[8] Moreover, the linear and non-linear analysis shows the impact of

Table 6.8 GDP OLS model 8/zekipr8 25%/75%, beta coefficients

VARIABLES	*(1) gdp2013*	*(2) gdp2013*	*(3) gdp2013*	*(4) gdp2013*
zekipr8	2.79	−4.56***	−5.84***	−0.97
	(8.234)	(1.084)	(1.295)	(3.548)
fdiin2013	0.03	0.03	0.05	0.06
	(0.085)	(0.045)	(0.050)	(0.055)
inf2013	−0.15	0.08	0.04	−0.16
	(0.209)	(0.112)	(0.095)	(0.334)
tr2013	−0.01	−0.00	0.00	−0.00
	(0.029)	(0.005)	(0.007)	(0.008)
Constant	−2.67	19.89***	24.65***	5.16
	(26.651)	(4.398)	(4.769)	(15.348)
Observations	17	55	53	19
R-squared	0.06	0.35	0.36	0.13
Adj. R-squared	−0.25	0.30	0.31	−0.12

Author created. Standard errors in parentheses.

*** p<0.001, ** p<0.01, * p<0.05.

exports, competition, GDP, and IPRs on FDI, which are major factor of the growth and advancement of AI economy.

Notes

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Conclusions

Due to AI technology in real life, it could be said that legal rules have to be adjusted in regulating behavior and capacity of individuals grounded in the use of machine learning and AI devices in taking into account and evaluating large volumes of personal data. Hence, AI technology has expanded human capacities, and digital networks are permitting sharing and new forms of creative production.

AI is transforming finance by enriching market forecasting, fraud detection, and portfolio optimization by offering unique insights, assisting informed investment decisions and diminishing risks. AI discovers fraud through continuous monitoring of transactions to identify potential fraudulent activities, which means that financial institutions are now better equipped to prevent fraud and notably protect their customers' assets. Thus, financial institutions proactively check and analyze transactions to spot anomalies indicative of fraud, and so, AI capabilities not only cut financial losses but also augment the security of customer assets, which means developing trust and confidence in the financial system.

It is characteristic that the digital economy depends on the organization of large amounts of unstructured data, accelerating the targeting of product offerings by corporations to individual consumers. To that extent, search engines rely on data from repeat searches to improve search results, sellers count on past purchases and browsing activities to make product recommendations, and social networks bank on selling data to marketers to generate revenue. Hence, data has become an indispensable resource in the digital economy, while the proliferation of cyberspace-based digital services and smartphones has made the formation and collection of data more reachable and cheaper than before. Thus, markets for data have increased connectivity between devices.

It has to be taken into consideration that finance encompassing data is digitalized, globalized, and regulated sectors of the global economy, and so, financial transactions are transfers of data, which means that financial infrastructures, such as stock exchanges and payment systems, are data networks. To that extent, financial institutions are data processors, collecting, analyzing, and trading the data produced by their customers.

Integrated markets have complicated states' capability to control macroeconomic conditions and the distribution of wealth. Governments are asserting sovereign control over data like land, energy, food, water, and capital, in a new epoch of geopolitical competition. Data control has commercial implications affecting

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economic competition between local corporations and global technology businesses. Nowadays, finance is dependent on data and its global movement. Financial data governance encompasses rules, processes, and strategies modeling the legal and regulatory framework of the digitization and datafication of finance.[1]

The obstruction of free-flowing digital finance generates disability, and so, the free movement of financial data across borders safeguards the stability and integrity of the global financial system, which includes global payment and settlement systems, interbank communication, central banking functions, financial supervision, and global coordination.[2] Cryptocurrencies are altering the rules of finance, exploding traditional concepts of money, and testing economic systems.

It is characteristic that increasing inflationary tensions, geopolitical anxieties, and systemic vulnerabilities within fiat currency frameworks have exaggerated worries about monetary stability, not to mention that cryptocurrencies, crypto-assets, alternative reserve assets, and excessive fiat issuance further aggravate risks, stabilization, and transformation.

While finance is undistinguishably related to data governance, general data governance regimes are not always harmonious and threaten to upset core policy objectives of stability, integrity, and security, along with the running of the global financial system. It is characteristic that data and algorithms are regarded as proprietary information property.[3] Data plays a fundamental part in digital political economy generating the informational capitalism; therefore, greater access to superior data is a crucial competitive advantage permitting corporations to build better algorithmic products and acquire better insights into their customers/audiences, which means pricing goods and services more profitably. In other words, data production is a crucial element of the digital economy because corporations can sell data directly, utilize data to enhance services, or exploit data in predicting, altering, or adjusting behavior.[4] Data allow corporations to value their users better than anyone else and make continuous improvements to their products and services, thus permitting corporations to retain their current users and add new ones. To that extent, Salomé Viljoen[5] argues that

> "social inequality is not a byproduct of unjust data collection, but is an injustice of concern in data production in its own right. This informs a different diagnosis of data-governance failure…datafication may be wrong not only because it manipulates people, but also because the social effects it produces or materializes violate standards of equality…may lead to unfair wealth inequality that violates distributive ideals of justice. As a social process, datafication may reproduce and amplify forms of social hierarchy that violate relational standards of justice."

It could be said that data governance should lead in averting any risk of social effects and rescuing spheres of life from private governance.

It seems that money has transformed into transactional data that large data-driven corporations, involving digital platforms, capitalize on in order to gain financial outcomes; therefore, financial technologies have become a new locus of

information warfare. The platformization of financial transactions has shaped an understanding that money is data.[6]

Taking into account that unfair conduct is anticompetitive, there is a need to standardize the elements denoting the context of fair competition, thereby creating a formalistic approach that generates certainty about maintaining fair competition in the market.

Geopolitical rivalries have stimulated greater protectionism by increasing the use of cross border restrictions on national security grounds. Policymakers have to square different and sometimes competing legitimate public policy objectives, such as fair competition, nondiscrimination, privacy, and security, while circumventing regulatory strain that inhibits socially beneficial innovations.

Taking into account that a country's economy can be held hostage under the threat of a halt to wireless services, technology can be "weaponized" by refusing vital parts in a trade war or in an actual conflict. The technology poses noteworthy systemic fears about the risks of system vulnerability, integrity, and availability.

Data management handles personal data processing, and markets should function within politically agreed-upon legal settings in order to avoid the creation of monopolies, indicating that politics decides and law regulates political decisions. Due to globalization, governments back their corporations to conquer global markets by supporting exports through economic and political strategies. AI globalization forces governments and corporations to adapt to new technological, ecological, and energy transitions. To that extent, Maxime Lefebvre[7] argues that

> "Business does not only undergo the law of politics, it can also be an influencer if it is able to organize itself and to formulate its own requests, in particular by practicing an adequate corporate diplomacy. I will give two concrete examples, one from the past and a more recent one."

Digital technologies and automation are furthering worries about the influence of market monopolies and the concentration of power. Jiaying Jiang[8] argues that

> "the most significant privacy concern arises from central banks collecting extensive end-user data. Such data aggregation raises alarms of mass surveillance, elevates cybersecurity risks, and poses potential data misuse or abuse by other government entities, especially in the absence of governing rules."

Digital platforms are influencing and reforming markets, and so, specific forms of exchange and value production are operationalized which means that information is utilized as part of a general platform strategy for competitive advantage. Hence, updated data allow for better predictions and strategies to manage human behavior.[9] It is characteristic that iterative data collection by platforms leads to dynamic and continually altering conditions of exchange and allocation; therefore, sole access to collected data confers intellectual monopolies[10] which implies a particular valuation of data in order to identify inefficiencies concerning market encounters.[11]

It is characteristic that informational capital and data have grown in value and so empowering digital platforms to conquer information distribution and digital

transitioning. Has the elite found a new way of dictating the behavior of the masses? Amy Kapczynski[12] says that

> "Our legal order, intertwined with the architecture of digital networks, has enabled the creation of vast new firms that wield new forms of surveillance and algorithmic power, but it also has delivered us a form of neoliberal capitalism that is inclined toward monopoly, concentrated power, and inequality."

It seems that platforms, algorithmic power, and informational capitalism are the fundamental factors affecting the current global economy and consequently people's social life.

ChatGPT has reformed the business world not only by advancing accessibility, efficiency, and cost reduction but also by empowering corporations' risk management capabilities and stock return performance. Hence, AI notifies corporations regarding their risk management capabilities, making it an ideal decision-support instrument in financial markets.[13] It has to be taken into consideration that with the rapid advances in natural language processing, AI systems such as GPT, the interaction between natural language law, automated computer analysis, and structured data will develop drastically. Thus, the task of transferring law into an AI form will become a reality, which means the advancement of AAI technology comes closer to the implementation level.

It is characteristic that tech giants such as GAFAMI (Google, Apple, Facebook, Amazon, Microsoft, and IBM) and BHATX (Baidu, Huawei, Alibaba, Tencent, and Xiaomi) are geopolitical competitors and have become de facto global stakeholders, which means that by collecting and analyzing global data, they have the capacity to offer personalized products and services on time.[14] On the other hand, it seems that GDPR and data localization have obstructed EU corporations in the global geopolitical AI clash.[15] In other words, the policy of some countries, in letting high tech corporations unregulated to overtake the global technology leadership, promotes their own economic and political status. Also, high-tech corporations via their technology law manage to avert any legal difficulties, counting basically on the conventional law principles for any disputes.

Due to data dealing with, AI confronts the standard of inventiveness by handling matters of "discovery," easily finding inventions obvious and thus raising the standard of inventiveness for developers and those skilled in the art. Hence, the outcomes of an AI invention vary based on the input data and/or the algorithms. It is worth noting that digitalization revolutionizes the conditions under which capitalism operates, and so corporations with superior data collection competencies profit as they exploit the information asymmetries.

Corporate governance aims at maximizing the value of the corporation for the benefit of its shareholders. Moreover, digital corporations are distinguished by a high intensity of utilization of new digital technologies in order to advance business setups, invent new business models, and improve business intelligence. It must be taken into account that the capability of a corporation to adapt to technology and exploit its prospective rests on its competence to translate those benefits

into products and services, processes, and new business models, and to secure and advance its competitiveness. Digital corporations are externalizing costs, and their positive attributes are considered a product of market efficiencies. Moreover, digital corporations are escaping countervailing principles that function as stopgaps or accountability devices to protect workers and third parties. Fundamentally, the rise of the new/digital economy has permitted corporations to utilize multiple facets of liability-limiting principles, without successful countermeasures, and so, countervailing law and policy are required to prevent economic asymmetry.

Successive transformative technologies such as AI, robotics, and the metaverse, among others, not only energetically reform industries, advancing corporate performance by boosting operational processes, increasing productivity, and reducing production costs but also have a noteworthy impact on financial markets, predominantly in the stock market, where technological firms are indexed. To that extent, the interaction between technologies plays a fundamental role in modeling the behavior of financial markets.

The possibility of AI surpassing human capabilities is on the table, and so, humans have to use their logic. However, if an elite takes the step to grant AAI humanoids free functionality under the assumption of being able to control them, there is a significant danger of causing chaos on Earth. Additionally, the next step should be the production of AAI humanoids using different materials than the current ones utilized for producing AI robots in order to achieve much better functionality. It is obvious that if AAI entities gain autonomy, then any human control is lost, which means that the next war will be between humans against humanoids. Of course, in an AAI society, the meaning of AI personality will be developed according to the demands of functioning within the AAI system.

Digitalization has empowered the customer to gather information and compare capabilities already in the process of defining their own needs, and so, the customer chooses the contact method, time, and communication medium. Also, digitalization and globalization have generated large platforms to break down and to localize trading practices; thus, markets, commerce, and sales are no longer merely globalized, but instantaneous localization is detected. It is distinctive that digitalization rates across advanced and developing economies are diverging rather than converging. Furthermore, gaps in digital capabilities expand rather than diminish existing divergences. Furthermore, low levels of connectivity and digitalization limit the likelihood of nations playing a part in new digital global value chains.[16] It is characteristic that the commodification and utilization of personal data stimulate data oligopolies. Digitalization and an ever-expanding industrial infrastructure are concentrated on the supply chain's production facilities via AI.

In fact, the risks from the rapid growth of financial technology increase while international FinTech governance declines, which means that risk multiplies from the rising mix of national security and financial stability components in financial regulation. Corporations and financial institutions have to augment AI utilization in risk management.

There is an ongoing "algorithmization" of governance raising fears about impending negative consequences that algorithmic biases or manipulations can

have on individual citizens' rights and the running of corporations and organizations.[17] Governments around the globe are contemplating different kinds of AI regulation, ranging from "AI ethics" to transparency necessities for public and private algorithmic decision-making. It seems that algorithmic systems concurrently serve as regulatory mechanisms, and so, the growing deployment of algorithmic systems in governing and regulating financial transactions is a kind of algorithmic governance that has emerged.

It is argued that the current technology of AI algorithms cannot be credited with authorship or copyright, and they still depend deeply on the creator of the algorithm, together with the team involved in training the machine and adjusting the parameters to produce the work. In Thaler v. Perlmutter,[18] the work lacked a human author, and the court granted the Copyright Office's request for summary judgment on the grounds that "human authorship is a bedrock requirement of copyright." Transparency in AI systems refers to the ability to value the input data, algorithms used, and resulting outputs; thus, the absence of transparency impedes accountability when these systems make decisions that considerably impact financial transactions and people's lives. Hence, transparency and explainability are elements guaranteeing the trustworthiness, accountability, and fairness of AI systems.[19]

It could be said that financial innovations should succeed while guaranteeing that the financial systems underpinning the global economy remain stable and responsible. Moreover, the digital economy dominated by a few privately run platforms should not preclude the emergence of more effective solutions, which means that it is critical to strike the right balance between enabling innovation and maintaining stability. Thus, central control has to be in the provision of public money acting as a trusted monetary agency, empowering the private sector to confidently develop innovative, value-adding financial products for consumers and businesses, and so allowing fair competition in the global AI economy. It could be said that incorporating formally standardized economic learning into the ex-ante presumptions and structured tests boosts competition enforcement and advances legal certainty for businesses.

It seems that states directly manage economic production and welfare provision, which means that policymakers are adopting a more active role by directly configuring wages, employment, and investment.[20] It has to be taken into account that new tools and applications are being created, and so, it is unattainable to keep track of regular developments, generating a background where it is difficult to form policies that are concurrently specific enough to tackle the risks integral to certain applications. Anyway, policies have to be flexible enough to utilize new technologies as they materialize.

It seems that currently AI technology is utilized by various entities in order to achieve subjective interests instead of achieving objectivity in implementing rules, which means that politics is using AI technology as an additional tool in achieving its conventional interests, such as promoting the interest of an elite against the interests of the whole society and not global objectivity in the application of the rule of law, etc.

The digital transactions not only step up and boost the value of illegal financial operations but they also demand flexible and harmonized responses from regulatory authorities. Cybercriminals are exploiting complex strategies to take advantage of the benefits of digital transactions, such as speed, cost-effectiveness, and global accessibility. The anonymous nature of cryptocurrency transactions has made it an ideal scheme for money laundering. To that extent, money laundering endangers the global economy's performance, and so, regulatory frameworks and the use of AI technologies for detecting and tackling illegal activity are essential in mitigating the threats caused by the dark side of cryptocurrencies.

AI pioneers a new sort of governance, which is grounded in energetic and adaptive decision-making processes driven by data, correlations, and predictions. Thus, AI platforms alter the character of speech governance by employing data analytics techniques.[21] Niva Elkin-Koren and Maayan Perel[22] argue that

> "Platforms should promote an infrastructure that would facilitate ongoing public engagement with speech norms. In some cases, this may involve securing independent access to content moderation outcomes to enable algorithmic contestation. In other instances, it may require platforms to enable access to public algorithms that would perform law enforcement functions."

More than ever, economic globalization will be burdened by the conflict over the delivery of natural and mineral resources, and so, de-globalization worldwide will be the geo-economic result. Economic trade and finance, the global availability of resources like gas, oil, rare metals, and food such as wheat, have turned out to be a currency of power, and existing trends in trade protectionism and economic sanctions will accelerate the undercutting of the principles of free trade and GATT. Thus, a progressively interconnected global economy, trade, and global affairs lead to a world's disorder. To that extent, Jörg Himmelreich[23] argues that

> "This fundamentally new political and economic situation of global markets and trade will present international companies with profound challenges for decades to come. The global economy and international trade and supply chains have become and will remain far more politicized, if not militarized, as currencies of power."

In other words, corporations will stabilize their trade relations and supply chains in times of de-globalization and geo-economic turmoil in order to stay competitive.[24]

Finally, it has to be taken into account that the global character of AI systems, on top of the interconnectedness of economies, necessitates cooperation in developing common principles and standards. Currently, technology itself is the regulating law of AI systems, and in a later stage law will come to regulate AI's basic functions influencing society while the newest AI systems will conquer the technical sphere unregulated and controlled by a superior technological system employed by the elite capital controlling the globe. The objective functioning of AI systems will impose fair competition in order for the system to function properly for the good of AI society. On the other hand, if AI society is grounded on a strictly centrally

functioning center, then there is the danger of monopolies to run AI economy. AAI humanoids will be merely instruments for operating a central electronic system with no freedom for personal creation and free speech, which means that the cons of running a conventional global economy and society will be transferred to another dimension by merely utilizing a new transformative technology. Let's hope that humanity will wake up and advance its own spirituality against any methods of avoiding dealing with its problems in life.

In the end, in the AI global economic setting, the AI international financial ecosystem continuously adjusts with stakeholders pursuing a balance between the necessity for orderly and effective restructurings and the competing interests of debtors, creditors, and other involved participants.

The Genius Act 1 deals with the issuance and exchange of stablecoins, a form of digital currency backed by another form of currency, like the U.S. dollar or a commodity like gold and protecting consumers, who then risk a failure to cash out their holdings in the event of a rapid, widespread offloading of coins.[25]

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